NE, 1942 VOL. 31, No. 6

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Industrial Arts and VOCATIONAL EDUCATION

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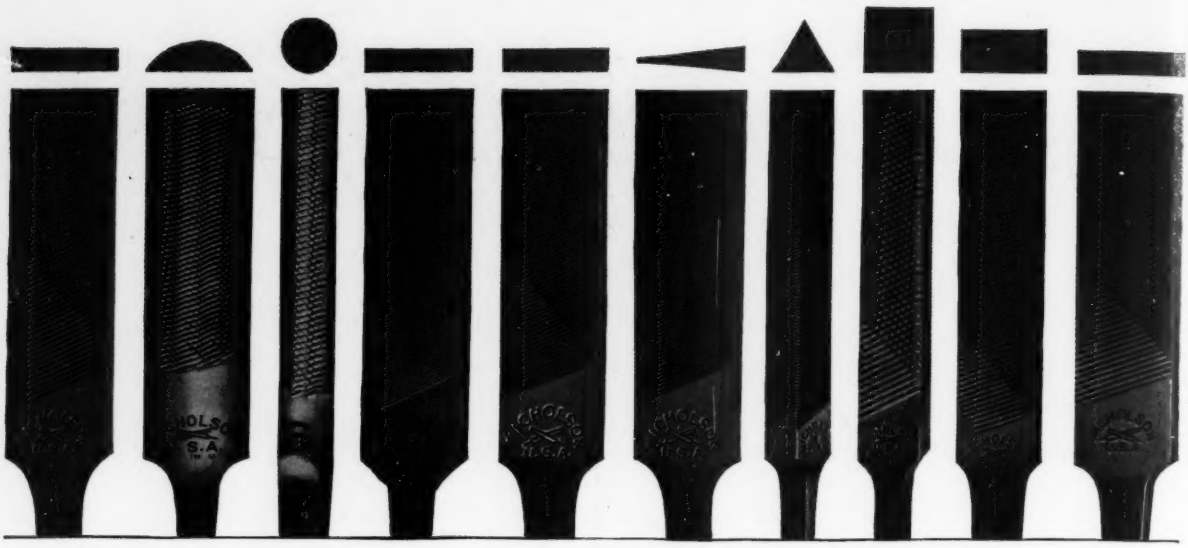
THE SHOP TEACHERS' PROFESSIONAL MAGAZINE



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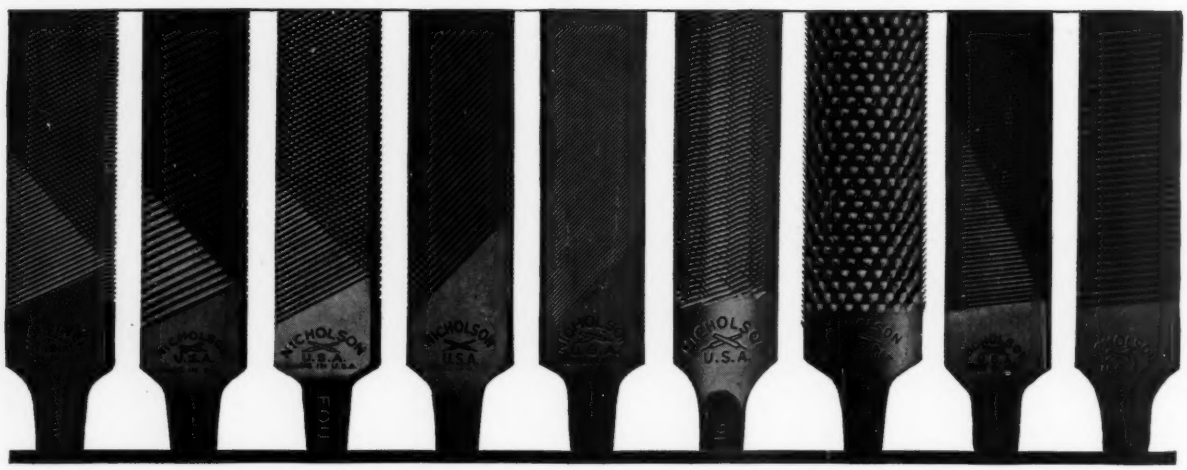

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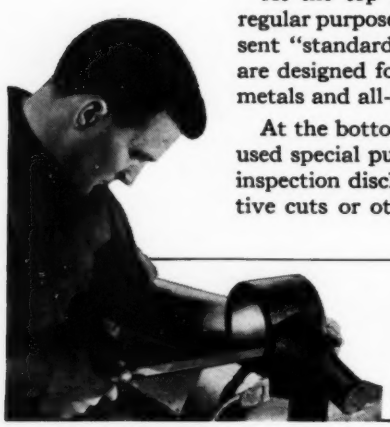

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INDUSTRIAL ARTS *and* VOCATIONAL EDUCATION

VOL. 31 JUNE, 1942 Number 6

1941-1942

We have arrived at the end of another school year. While the conditions in the world are far from bright, those of us who have the privilege of contacting the school-shop teachers of this country through the medium of the INDUSTRIAL ARTS AND VOCATIONAL EDUCATION Magazine, express the hope that all school teachers may derive great benefits from the vacation period which is about to start.

YOUR NEW ADDRESS

Since INDUSTRIAL ARTS AND VOCATIONAL EDUCATION is not published during July and August, it will do no good to send us your summer address, but do please furnish us the address to which your magazines are to be sent after the reopening of school in September. Attention to this will ensure the proper delivery of every issue of your magazine.

THIS MONTH'S COVER

The illustration on the cover shows a group of students of the Armored Force School, Fort Knox, Ky., working on a big Diesel engine.

The cut for this picture, as well as all those for the illustrations used in Captain Henson's article on pages 229 to 231 inclusive, were made from photographs by the Signal Corps, U. S. A.

For Victory

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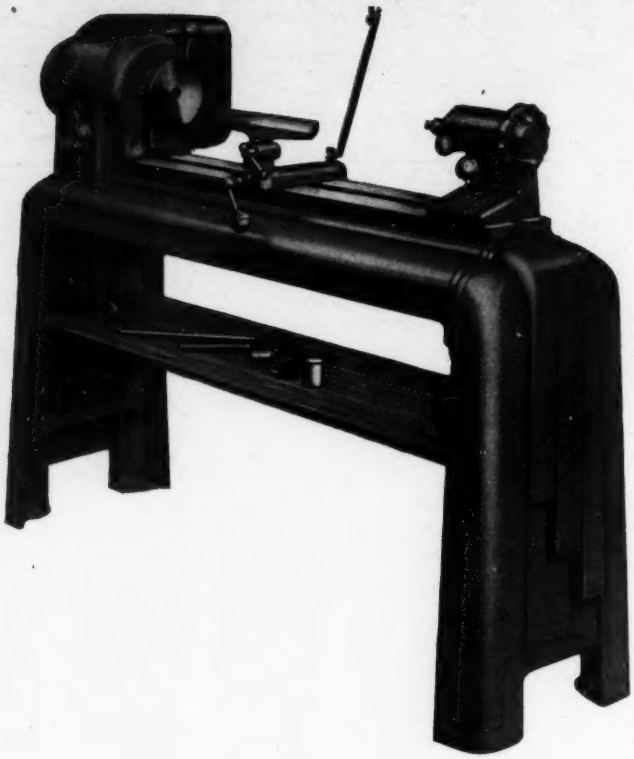

J-72 SPEED LATHE

VETERANS of the teaching profession, and graduates about to start out on their first position both recognize this lathe to be an excellent piece of equipment. Older instructors perhaps know it better as the T-12 Lathe. Newcomers in the field are more familiar with it by its newer name, the J-72 Lathe.

By whatever name it is known, the fact remains that this lathe is positively a superior type of machine. It is safe and easy to operate. The 4-speed motor can be started only when the control lever is at its lowest speed, and then only by the use of the starter button. It may be stopped by simply pulling the brake lever which is interlocked with the switch.

The J-72 has many other features which recommend it for school use. It has a positive-acting spindle lock; easy clamping tailstock; front-locking, non-clogging tool rest and a glow lamp which indicates at a glance when the motor is running.

The same smooth lines which make this machine modern and attractive in appearance also make it safe and easy to keep clean. There are no sharp corners and crevices . . . the headstock, bed and legs are shaped to shed chips and shavings to the floor. Let us send complete descriptive information. Write today.

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Short Talks on Wood

BLACK LOCUST (*Robinia pseudoacacia*)

One of the heaviest and hardest of our native hardwoods. A legume or pod bearer, botanically related to the garden pea. Wood has great strength and resistance to shock. Close-grained. Difficult to season and work. Heartwood is very durable in contact with soil.

Widely used for fence posts because of its durability, rapid growth and easy propagation. Also useful for poles, mine timbers, insulator pins and shipbuilding.

Its natural range is the Appalachian Mountains from Pennsylvania to Georgia and parts of Illinois, Indiana, Arkansas, Oklahoma and Tennessee. Has been naturalized, however, in most of the states east of the Rocky Mountains. Makes its best growth on moist, fertile soil. Spreads from underground stems which makes it a good tree for producing mass vegetation on rough, eroding land.

An attractive tree with an open crown and long, spreading, graceful branches. May attain a height of 80 to 100 feet and a diameter of 30 inches. Twigs are armed with sharp, strong spines. Desirable for street and lawn planting although it is subject to attack by the locust borer.

The bark is reddish-brown and deeply furrowed. The leaves are compound, alternate, from 8 to 14 inches long, having from 7 to 21 leaflets. Cream-white, fragrant flowers resembling the pea blossom appear in May and June. Fruit is a smooth, flat pod about 3 inches long containing 4 to 8 small brown seeds.

To date, thirty-six brief articles similar to the one above and dealing with the more commonly used woods have appeared in these ads. As in the past, we continue to invite your suggestions as to the species of wood you would like featured in this series.

YATES-AMERICAN

INDUSTRIAL ARTS *and* VOCATIONAL EDUCATION

Technical School of the Armored Force

CAPTAIN HENRY B. HENSON*

One of the greatest technical schools in the world has been hewn from scrub growth and blackberry patches on the rolling terrain of Fort Knox, Ky.

The Armored Force School, of which Brigadier General Stephen G. Henry is commandant, was activated to train the vast number of technicians needed for the hard-hitting, fast-forming divisions of the armored force, mechanized part of the army and newest of its arms.

Now little more than a year and a half old, this "blitz college" is geared to graduate more than 38,000 officers and enlisted specialists and new officers a year in a unit of 495 buildings, 47 of them used for instructional purposes alone. Already, nearly $20,000,000 worth of carefully spent funds have been used in this undertaking. A "faculty" and staff of nearly 250 officers and 1950 enlisted men operates the unique institution, geared to "keep 'em rolling."

Not only one of the largest of the army's service schools, the Armored Force School's gigantic annual human output exceeds the number of yearly graduates from any civilian university or college in the United States.

Existence of this all-American educational institution has made Fort Knox more than "just another army post." The civilian who may think first of the gold vaults under the clay of Knox, now may contemplate the importance of the Armored Force School, the fact that the post itself now is third largest in the United States and the third largest population concentration in Kentucky and that the armored force is the only arm of the service whose chief steadfastly declines to take a desk in Washington. This has been the wish of Major General Jacob L. Devers, chief of the armored force, who has preferred to remain with his command afield.

It must be remembered that the armored force, itself successor to the old tank corps and the mechanized cavalry, was organized only in July, 1940. In quick order, the Armored Force School began to take shape on August 7 of the same year, and a scant three months later, on November 4, its first students sat down in the classroom.

Since then, the school has been expanded to such proportions that its communication department now ranks with the signal school at Fort Monmouth, N. J., where signal corps personnel are trained, while its clerical department is far larger than the usual civilian business college. Its gunnery department boasts a new indoor range thought to be the largest of its kind in the world.

Although the Armored Force School is concerned primarily with the training of officers and men for the specialties of war, General Henry feels that most of the in-

Brigadier General Stephen G. Henry, Commandant of the Armored Force School (right) and Lieutenant Colonel Verne C. Fryklund, head of the teacher-training department, go over plans for the department, "baby" of the school's academic sections

* Commandant and Staff Section, Headquarters, Armored Force School, Fort Knox, Ky.

Students firing from "wobble plates"

Class in radio operation

dividuals who flow in and out of the school are acquiring knowledge which may be of benefit to them the rest of their lives. Thousands of specialized technicians are being trained, all of essential value in peace as in war.

Nine departments comprise the Armored Force School — tank, communication, wheeled vehicle, motorcycle, gunnery, tactics, clerical, officer candidate school, and the newest, teacher training. In these are schooled such specialists, essential in war and peace, as radio operators and cryptographers, radio electricians, motor mechanics, maintenance officers, welders, blacksmiths, motorcycle mechanics, clerical specialists, and even cooks and bakers.

Officers and men completing courses in the Armored Force School are awarded regular certificates of graduation, and many times leaders prominent in various fields are brought in to address the graduating classes.

The 3595 vehicles of an armored division require even more tender care than the animals of the so-called "horse cavalry." It is an adage at the Armored Force School that a "tank does not take care of itself." And so the training of skilled technicians and maintenance men is a major objective of the school.

Unlike the high school or college student, who may think that 8 o'clock classes are too early, Johnny may be at his desk at 6 a.m. in America's "blitz college." This, in order that a second shift may use the classroom from 1 to 8 p.m., after the first finishes.

This was not the system at first. But with the rapidly expanding need for instructors and specialists in the quick-forming Armored divisions, hours had to be utilized to their fullest. So, the school more than a year ago went on a two-shift basis, and recently increased the time for its class hours, making possible a reduction in total time required to complete many courses, thus accommodating a greater intake of students.

These students, incidentally, come to the school without geographical limitation, being assigned from 10 other United States army posts having armored force units, and from other installations and undisclosed stations. Thus, most of the 48 states are represented in the school at all times.

The speed-up in graduate output has been accomplished in the main without expanding the educational section of the plant itself. In the manner of mass-production methods used in the automobile industry, it was decided some time ago to overlap class units in such a way that one would begin before another had finished. Major courses were broken down into phases. The tank department of the school, for example, is divided into eight phases of six days each. By introducing a new increment of 140 students every six days, 1120 students in this department alone can be trained at the same time. A student thus moves from the first phase into the second, and so on.

Consequently, a student who may become ill during a course can start again with only a few days' loss. Likewise, a man who must be granted an emergency leave or furlough can pick up again rapidly without waiting for the start of another course, inasmuch as new phases begin every six days.

Moreover, a man who may be slow because of a lack of previous education can be put through a phase a second time. This phase system also is excellent in the training of instructors, who can be put through a particular phase more than once in preparation for teaching it.

The latest step-up in the school's output followed Pearl Harbor. The length of virtually all classes was reduced, both shifts were lengthened to seven hours from six and all courses were placed on a six-day basis where some had been five and one half days.

The school recognizes the advisability of frequent breaks for rest and for shifting

Colonel Fryklund's teacher-training staff, shown here, are from the left: Ray Karnes, former supervisor of defense training for the state of Missouri; Roy E. Howard, former curriculum expert for the Detroit public schools; Dr. William J. Micheels, former assistant professor of industrial education in the University of Minnesota; John A. Jarvis of the Flint, Mich., public school system; and Einar Siro, of the Minneapolis public schools

around of groups from one type of instruction to another within a particular pursuit of study on the same day. Tedium thus is minimized.

Courses of study vary in length. The tank department teaches an eight-week course to create tank repairmen and tank maintenance officers. The wheeled vehicle department in the same length of time supplies motor maintenance men and motor officers. Radio operators and cryptographers get their training in the communication department in a 14-week period, radio electricians in 10, communication officers in three months.

In the motorcycle department, repairmen are turned out in eight weeks. It takes four weeks to train a gunnery instructor, officer or enlisted. The clerical department in one month now trains an enlisted specialist in the vast paper-work duties of keeping an armored division on its feet. And those entering clerical classes now are required to know typing beforehand.

The officer candidate school of the Armored Force School offers a second lieutenant's commission to selected enlisted personnel after three months' basic training and three more in its grueling courses.

An aptitude test is given all students when they first come to the Armored Force School. Any of three covering code, clerical, or mechanical aptitude, are used. In addition to determining the course an individual should follow, these have served almost uncannily in the correct grouping of men in fast or slow-learning units and according to rural or urban backgrounds. This has almost entirely eliminated the possibility of personality difficulties in a student's progress.

Visual aids are utilized to the greatest extent throughout the Armored Force School. Movie strip films, working models, diagrams, and charts all are used. Full-size cutaway models are used to demonstrate even the minutest working parts of all armored vehicles. In the Armored Force School there probably is the largest exhibit in the country of cutaway models used for instructional purposes.

In all subjects, instruction is by discussion, demonstration, and practical work.

In addition to the technical division of the school there are the training group and the demonstration regiment. The training group, acting as a *housekeeping* unit, is responsible for the feeding, paying, administration, and basic military instruction of Armored Force School students. The demonstration regiment represents a miniature armored division and presents tactical demonstrations for other departments. The school also operates its own reproduction department, to produce all charts and printed materials needed in its operation, a publication department for issuance of correspondence courses on armored force subjects for military personnel and its own library.

Recently, General Henry felt that inasmuch as the school's training periods are so brief and the requirements so exacting that a teacher-training department should be added to focus instructional methods into the latest practices. He called in Dr. Verne C. Fryklund, associate professor of industrial education in the University of Minnesota, to survey the need. Shortly afterward, Dr. Fryklund was commissioned a lieutenant colonel, Army of the United States, and he established a teacher-training department in the school.

Around him Colonel Fryklund has gathered a staff of leaders in industrial education. These include Dr. William J. Micheels, assistant professor of industrial education in the University of Minnesota; Ray Karnes, supervisor of defense training for the state of Missouri; Roy E. Howard, a curriculum specialist in the Flint public schools; Einar Siro, of the Minneapolis public schools; and John A. Jarvis, of the Flint, Mich., public schools.

Most of Colonel Fryklund's staff hold more than one degree and all have had wide experience in the industrial education and vocational fields, and all are expert tradesmen.

Colonel Fryklund, before coming to the University of Minnesota, was supervisor of vocational education in the Detroit city school system. He is a fellow in the American Association for the Advancement of Science, a life member of the American Vocational Association, and Michigan Industrial Education Society, a past president of the American Association of Teacher Trainers in Vocational Education, permanent chairman of the Manual Arts Conference, and a member of innumerable other education associations and honorary societies.

He is the author of five books, and has written numerous bulletins and magazine articles.

Despite the fact that four years are required to train a good teacher in a teachers' college, Colonel Fryklund has streamlined the new Armored Force School teacher-training department down to a course of 12 weeks. This is designed to guide officers and enlisted instructors in teaching students effectively the greatest amount of material possible in the shortest space of time. Under the present schedule, teacher-training classes are being held one hour each day, six days weekly. Of the department's mission, Colonel Fryklund has this to say:

"Learning in shop instruction is habit building. A given lesson must become part of one's life so it will function automatically. If the learner merely has attained a passing attainment, he has not qualified. Either he or the teacher has failed. When the lesson functions automatically, it has become habit. When the lessons are so well learned that they are habits, then confidence and speed are established." And he adds:

"The emergencies under which combat repair work must be carried on call for concentrated attention on developing habits of accuracy and speed and confidence in doing well the necessary repairs. All this requires first-class teaching and a continuous program of teacher improvement in the Armored Force School."

The teacher-training department is housed in a special building, in which formal teacher-training instruction is presented. A teaching certificate is issued those who complete the course, and all teachers in the Armored Force School hereafter are being required to hold his certificate. A follow-up visitation of teachers in service is standard practice of the department.

To one man alone must go the great bulk of the credit for the success of the vast Armored Force School. That man is General Henry himself.

He is a man who virtually never sleeps on an unsolved problem. His life is a forceful example of driving, pushing achievement. Louisiana-born, General Henry was graduated from Louisiana State University, received a second lieutenant's commission and went into the army. Now only 46, he is a brigadier general after 25 years of brilliant service.

As founder and boss of this American "blitz college," General Henry takes a personal interest in every officer and man from the school's headquarters down to the lowliest enlisted man in some cranny of its machine shops. From his youth he has been interested in machinery, always liking to tinker, tear down, and rebuild. If there is something mechanical which he does not understand, he never is content until he learns all about it.

Possessed of boundless intellectual curiosity, the general has pursued special courses in the Massachusetts Institute of Technology and has acquainted himself with the workings of Detroit's great motor plants — just to learn how industry solves its pressing problems.

If he likes machinery, he loves people better. In many men, such a combination of likes would be paradoxical; with General Henry it is natural.

To two of his most "right-hand" men, General Henry likes to credit much of the success of his "blitz" institution. They are Colonel Robert G. Howie, executive officer of the school, and Lieutenant Colonel W. E. Watters, secretary.

Colonel Howie, a rare combination of talented pianist and automotive inventor, is known widely in service circles as "father" of the "peep" car, tiniest of an armored division's vehicles. Colonel Watters, in a comparable civilian institution of learning, would, in effect, occupy the position of dean.

And so vocational education plays a vital part in a democracy at war. Geared deeply into the war effort, its leadership will assure the American people that nothing will be left undone to give them the most effective offense effort possible in the gigantic task of saving democracy.

Training Machinist Apprentices for National Defense

S. THEODORE WOAL*

The Federal Government has for many years been training machinists through an apprenticeship system in the arsenals and navy yards of the country. Apprentice machinists are paid employees of the government, selected by civil service examination and subject to civil service regulations. The Civil Service Commission requires a grammar school (or its equivalent) education for admittance to the examination for apprentice-mechanical trades. The examination consists of an intelligence and a mechanical aptitude test. Placement is based upon relative standing on the register and an oral pre-hiring interview.

Apprentice machinists undergo a training program for a period of four years. They are issued papers as journeymen machinists on successful completion of all the required studies.

The training program discussed in this article is the method employed for developing machinists at the Frankford Arsenal in Philadelphia. The trade school is at present training over 400 apprentice machinists.

The school is situated in a building which houses all forms of modern machine tools, a toolroom, and an inspection department. A section of the building is given over to classrooms for instruction in related machine-shop subjects. Apprentices now work a six-day week, eight hours per day. During the first year they learn to operate all the usual machine tools, receive training in mechanical drawing; blueprint reading, shop mathematics, and theory.

An individualized instructional procedure is used throughout the training program. The apprentice leaves his machine only for those periods of the week during which he receives instruction in the related subjects and returns to his machine to continue the particular job on which he is working. Instructors are all journeymen machinists and engineers who have had many years of experience in the type of work required of machinists at the arsenal.

A cumulative weekly record is kept of every apprentice. The record indicates the progress made in shopwork, shop habits, and related machine-shop subjects.

Scope of the Training Program

The training program develops in the apprentice all the skills required for participation on the journeymen level in the several departments of the arsenal. During the first year in the trade school apprentices receive instruction in the following fields.

1. Machine-shop practice and shop theory
2. Trade technology and shop mathematics
3. Mechanical drawing and blueprint reading
4. Machine design
5. Metallurgy and metallography
6. Engineering mathematics

Successful completion of parts 1, 2, and 3 of this program is required of every apprentice. Parts 4, 5, and 6 are extra-curricular subjects of a voluntary nature arranged under the vocational training for National Defense Program.

The general course of this study outlined, is based on the special needs of the arsenal. The shop problems, mechanical-drawing projects, and mathematics curriculum have been formulated upon actual jobs that have been completed or are in the progress of completion in the trade school or other shops in the arsenal.

The jobs being done by the apprentices are in no sense practical problems. Each job, including the apprentice's first, eventually finds its way into some jig, fixture, repair part, or shell actually used.

Basic Training

The objective of the work in mechanical drawing is to give the apprentice sufficient training and experience in the methods and techniques of mechanical drawing and blueprint reading, to enable him to visualize a drawing, make freehand sketches, properly dimension them, and to design and detail a given piece of mechanism.

Each apprentice receives 240 hours of instruction in these subjects. One half of the time is given to basic training in the fundamentals of projection, freehand sketching, and mechanical construction. The final 120 hours consist in original empirical design of jigs, fixtures, punches, dies, or other special design jobs called for by shop orders.

Theory of Shop Practice and Shop Mathematics

Each apprentice receives a total of 240 hours of machine-shop mathematics and shop theory. Here the objective is to give the apprentice training in the use of mathematics as a tool in the solution of shop problems, and a knowledge of the theory of machine-tool operation. Consequently, all the basic machine tools are critically analyzed. In addition, the machine-tool attachments, such as the dividing head, are studied. Special machine-shop checking methods and inspection technique are taught. In brief, the course consists of:

1. Arithmetic and algebra
2. Machine tools: lathe, shaper, milling machine, grinder, drill press
3. Gearing and its applications
4. Cutting speeds and feeds
5. Taper turning
6. Screw Thread Systems
7. Indexing
8. Geometric construction and layout
9. Practical geometry applied to the solution of shop problems
10. Shop trigonometry
11. Inspection and checking methods and techniques

The mathematics is concretely related to the shopwork. Problems are drawn from the job being worked on in the shop. Inspection and checking methods learned are those employed in the various departments of the arsenal.

Advanced Training

After successful completion of one year's basic training in the trade school, the apprentices are sent to the other departments in the arsenal. Departmental selection for advanced training is usually made on the basis of proved aptitudes as indicated on the cumulative record.[1]

The outside shop training is conducted in the artillery, small arms, instrument, and fire control departments. In these shops the apprentice takes his place with the other workers under the general supervision of the shop foreman. Training continues as the apprentice applies acquired knowledge and learns new methods and techniques. Again, the work done is not of a practice nature but rather on regular allocated jobs.

In the artillery and small arms departments, the apprentice is concerned with the making of jigs, fixtures, punches, dies and toolroom work, carrying each job through all its required operations.

In the instrument department the apprentice spends about 6 months in each of several sections — lathe, toolroom, milling, assembly, working on parts for gun sights, gun mounts, and the like.

In the fire control section the apprentice is trained in the construction and design of mechanisms for control of fuses.

Summary

The training program at the Frankford Arsenal is of a practical nature. From the first day the apprentice is engaged in work which has definite utility for national defense. The advanced training in the several departments of the arsenal gives the apprentice a well-rounded machinist training, facilitating his use where he is most needed.

*Instructor in Related Mathematics, Trade School at Frankford Arsenal, Philadelphia, Pa.

[1]National Emergency conditions, however, have required allocation of apprentices according to personnel needs of departments.

Vitalizing Elementary and Secondary Education Through the Practical Arts*

WILLIAM F. RASCHE**

Man has practiced education empirically from the beginning of history. Scientific education, by contrast, is hardly half a century old. As in other fields where man labors, we in education are face to face with innumerable challenges because the science of education has revealed and is revealing educational discoveries which are forcing us to consider critically and analytically everything in education which we have in the past accepted as good and sufficient. Like the physicist, the chemist, and the engineer we are challenged to reappraise our theories and practices, and to improve our methods to the end that we may streamline education and increase our educational efficiency.

The general thesis for this discussion is responsibilities for "Vitalizing Elementary and Secondary Education Through the Practical Arts." That is a timely thesis, for there is great need that our schools, effective as they are, increase their efficiency by supplying more *vitality* to their services. To furnish *vitality* is to supply *life,* to provide *vigor,* and to give *energy. Vitality* is a dynamic term. Wherever *vitality* is present, there is to be found a continuing force of energy through which accomplishment is achieved. It is very important to vitalize education, to energize it, and to make it vigorous.

What responsibilities have we in the matter of vitalizing elementary and secondary education through the practical arts? In a short article like this one can but scratch the surface to give a few high lights. For that reason but *three* subsidiary theses will be touched upon in which a few of many means for vitalizing education on these two levels through the practical arts will be emphasized.

The *first* is the necessity of breaking down the insulating partitions which separate the school subjects and thereby permitting an integration in which the practical arts as well as the other subjects may play their part more fully in achieving functional objectives.

The *second* is the incorporation into the elementary and secondary curriculums of those fundamentals, both informational and practical, which will condition high school graduates for the world of reality and not merely for the university.

The *third* is the two-way extension of coeducation on the secondary level in the area of homemaking and practical subjects so that both sexes may be benefited more widely than is possible under the plan generally prevailing in most places today.

In considering the first thesis — namely that there must be greater interpenetration of the school subjects — practical and academic — on both the elementary and secondary school levels, an analogy may be useful. The human body is an integrated organism. It is a composition of structures and organs which are mutually dependent upon each other. A live functioning human being cannot live if this interdependency is destroyed. A human skeleton by itself is a dead aggregation of bones — wholly devoid of life. A circulatory system and a respiratory system of the same body wholly separated from each other cannot function. Their separation would mean their death. A digestive system by itself and disconnected from the other systems of the human body can neither sustain life nor have life. A nervous system separated from a muscular system can control no human action and the muscular system so uncontrolled can perform no work. If the human body is to have life and vitality, its various functional systems must be properly united and integrated in one body. When they are so properly co-ordinated in a living person, each system can have vitality and function normally and the body as a whole can continue to live.

In education we lose much of our effectiveness because we dissect the whole curriculum into parts and thus fail too often to relate them properly to each other. So much of schoolwork is dead and lifeless because the various school subjects are taught and administered as separate compartmentalized activities without any or much relationship to each other. Yet by building core curriculums much unity in instruction could be achieved and each of the contributing subjects strengthened because their functional worth would be greatly enhanced and promptly sensed by the student. When so co-ordinated the student can see some connection between everything that is offered him by his school. Integration supplies the answers to the questions "What is this for?" or "Of what use is this?" which persistent young people so often put to their teachers.

To be sure, in American educational institutions here and there, men and women are to be found who have stepped ahead in this direction, sometimes in a small way and in other instances in a more ambitious manner. But by and large we in America have yet to go a long way before we lose the fetters that chain us down to practices that we have known for such a long time.

Why haven't we discarded them? There are several reasons. The prerequisite demands of universities and accrediting associations have to a large degree been responsible for the straight jackets that have hindered freedom of action on the secondary level. Then, too, our public whose children we educate, is not always tolerant of prompt, progressive, and necessary change. Coupled with this is our own inertia which makes it much easier to hold to the old ways and continue in our compartmentalized ruts with the result that teachers of the different subjects struggle to keep a place in the sun for their respective departments and a favorable spot in the school schedule.

Notwithstanding the reasons that account for the insulation of the school subjects, forward-looking schoolmen and school women sense that educational science will not long sanction the unnecessary retardation of high school youth. They will seek to end the domination of high schools by higher institutions of learning and revise their own practices so that the secondary schools may truly vitalize their services to their students. This freedom is needed to apply educational science in our secondary schools to meet the pressing needs of youth in a rapidly changing industrial order. All that the higher institutions have a right to ask is that the students sent to them shall have capacity to profit from their offerings and the energy and industry that are requisite to a successful pursuit of college or university courses. Enough scientific experimentation in education has been undertaken to date to show that the possession of aptitude for university work, interest, and industry, and not exposure to specified curriculums is the only legitimate prerequisite a higher institution has a moral right to require of the graduates of our secondary institutions.

When our secondary schools take and use the freedom they need to fulfill their proper functions, they will integrate their instructional offerings far more closely than they do today and they will use the practical subjects as cores around which to build their integrated services. Many schools have tended to move in that direction and more will as the restrictions upon them are eased by accrediting schools on higher levels.

Fortunately, experimentation, sanctioned by higher institutions with selected high schools, is breaking open the obstructions that have thus far prevented our secondary schools from assuming their full role as schools organized to meet the needs of all their students. It is a recognition of the fact that our high schools have universal appeal and are no longer selective institutions whose chief function is to prepare people for college or university. The day is at hand when the high schools of our country must meet their responsibilities fully so that all the students they receive may be served equally well irrespective of

*Address given by Dr. Wm. F. Rasche before the members of the Wisconsin Industrial Arts Association.

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what the ultimate goals of those students may be, goals that lead to college for some, but to industry, business, and the farm for many others.

In the change-over our secondary schools will unquestionably recognize:

1. That Spencer spoke truly when he said that "to prepare for *complete* living is the function that education has to discharge."

2. That such an objective calls for a balance of interests — civic, home, intellectual, moral, physical, vocational, and avocational.

3. That all such interests call upon the individual to express himself through *activities* which he can perform properly only when he has acquired the proper knowledges, understandings, attitudes, and skills.

4. That to the extent that organized schools contribute to the individual's education in these seven areas they must provide practical activities in proper learning situations to aid in accomplishing these objectives. Courses in the practical arts, whether shop and drafting courses such as boys are now offered, and courses in homemaking and the crafts as are offered girls, play their part in this program. But under the more adequate program here suggested such practical courses will have to be integrated with the academic subjects, and the academic subjects with them, far more fully than they are today to vitalize all the subjects offered in all seven fields in the manner here proposed.

Let us now consider the second thesis — namely, the incorporation into the elementary and secondary curriculums of those fundamentals, both informational and practical, which will condition high school graduates for the world of reality as well as the university. In our elementary schools we offer all pupils, boys and girls alike, a three-R curriculum known as the tool subjects. We require every youth to learn to read, write, and cipher. Any elementary school that does not graduate its pupils possessed of some fair control of these tool subjects would be justly condemned by us. It is inconceivable that young people should pursue academic specializations in the content subjects without being able to read, write, and cipher. Therefore we have decreed that everyone must be taught to acquire these academic skills and use them.

Yet, when we deliver our high school youth to society and place them in a real world, we do not see to it that they have achieved a similar mastery over another set of tools highly important in their adjustment to a world teeming with practical activity, another set of tools just as important as the academic tools given them in our elementary schools. Just as academic literacy is essential to every individual's education, so, too, is mechanical literacy imperative for him in a machine age and an industrial civilization. Just as every individual is expected to master the R's in the elementary schools, so, too, should he be required to master the fundamentals of the three M's — *machines, materials,* and *manipulative processes* through the application of physics and chemistry in industrial laboratories where practical activities involving the use of tools on materials and equipment will challenge students to work mentally and manually on problems that call for orientation in science, mathematics, blueprint reading, safety, and other related technical items on an integrated basis, as well as for the exercise of manipulative skills they need to develop.

These challenges must be in the form of problems dealing with practical situations everyone meets in everyday experience. The laboratories needed for this purpose are not woodshops nor machine shops of the traditional type. Rather, they need to be industrial laboratories where opportunity is afforded our youth to use hand and machine tools in working with a large variety of equipment that would give them not only a minimum of practical skills such as are now acquired in specialized shops, but a much wider range of understandings and appreciations than the present practical arts as usually offered provide for them.

Specifically, this calls for close co-ordination and careful curriculum planning between teachers of the various departments of instruction — the shop teacher, the mechanical-drawing teacher, the art teacher, the science teacher, the English teacher, the mathematics teacher, the social-science teacher, and the occupations teacher. All must work together closely in such a program. The instruction offered — both basic and applied — would include many practical units of instruction which relate directly to life problems and situations, such as are found in the home, on the street, in the factory, the countinghouse, and the store. It would touch the points of universal experience of people generally.

Practically everyone rides in automobiles. Practically everybody uses electricity. Everywhere people are dealing with many kinds of mechanical equipment — furnaces, boilers, ventilating systems, refrigerators, sewing machines, vacuum cleaners, radios, telephones, electric lights, electric table accessories, machine tools, plumbing, thermostatic controls, etc., as well as many kinds of materials. People use chemical agents, plastics, metals, woods, papers, leathers, compositions, and so on *ad infinitum,* down a long list of materials. Studied as sheer physics or chemistry, these subjects have appeal only to our *stronger* students. Reorganized to life situations in a practical laboratory where tool and machine processes can be integrated with the essential types of related subjects, the instruction can be vitalized and fitted to the interests and life needs of *average* students as well.

There still would be need for basic instruction under the specialized plan — in mathematics, science, art, drawing, English, social studies, shop, and so on. But the basic subjects teachers would consciously co-ordinate their activities more closely to serve functional objectives. The practical applications students would make in the integrated program of the industrial laboratory would have a unifying effect that would give every educable student exposed to this experience control of the three-M common denominators everyone should be able to control in our complex industrial life. This fundamental training will prepare students for later vocational specializations, whether pursued in school or on the job, just as the three R's prepare them to deal with the academic content subjects and academic specializations in grade school, high school, and the universities. Such integrated practical experience should provide a *mechanical readiness* which will give students a good start in actual employment situations. Likewise, if they transfer to some university, this broad and integrated experience will enable them to pursue their university work more effectively because their cultural enrichment will have been increased over what it would have been had they pursued exclusively a secondary program of the strictly compartmentalized type — commonly known as 16 units of instruction — the stint required for graduation. We may reasonably well expect that the combination of correlated academic and practical education insures a better cultural or vocational education than either one alone pursued without grounding in the other.

The third thesis I have suggested for consideration is that breadth of understanding and versatility in manipulative experience must be given to both boys and girls. We have accepted coeducation without question for both sexes in teaching them the academic subjects and the basic sciences. But our practice today is very largely to send girls to cooking, sewing, and craft rooms without boys, and boys to shops and mechanical-drawing rooms without girls. Only here and there do we note exceptions. We educate boys in a manner that does not adapt them to assume their full part in the home. Likewise we educate girls in a manner that does not completely adapt them to deal intelligently and effectively with the mechanical problems they must reckon with in their homes and elsewhere. Although this article is not devoted to a consideration of the problems of homemaking, it is in order to say that boys should be given a better fundamental education in school concerning many items properly presented in a homemaking curriculum, and also that it is in order that girls should be permitted to work with hand tools and light machinery in a practical laboratory which provides opportunity to develop manipulative skills, and provide adequate orientation in dealing with mechanical equipment and materials such as our modern industrial age has provided for our use.

Both boys and girls drive automobiles, both use electrical equipment, both work in hundreds of occupations where simple processes and mechanical principles must be understood. Both are beset by the same hazards and dangers that are part of our complex life. Both, for protective reasons, should be schooled in those fundamentals, which when once understood, will insure their personal safety while achieving efficient results, but which, when not understood, as now take an unwarranted toll of human life. This death toll of those who come to their own destruction because of mechanical illiteracy is altogether too high to justify indifference to the great need a three-M curriculum can meet.

Such a core curriculum, incorporated into our secondary program of education, designed to vitalize that program by fitting students for life without unfitting them for schooling in universities or colleges, should be available to boys and girls alike.

The proposed curriculum is possible of inclusion in the secondary time schedule because the period of school life is lengthening for youth. This is due to a decline in the birth rate, the increased proportion of adults to youth, technological improvements, the exhaustion of the supply of free land, and other forces, all of which are tending to raise the age when young people can hope to begin work in business or industry. As a consequence, because the school life of young people will be longer, vocational specialization for most of our high school students in our urban communities can be deferred until they leave the high school as we know it today. Although we are now experiencing a temporary prosperity that will reverse this tendency for the period of the present emergency, the force of economic and social trends will lengthen the secondary school period by several years to a point that will ultimately include those years that are commonly known as the junior college years. Henry Morrison knew whereof he spoke and wrote when he properly designated the mid-point of what is known today as the four-year college period as the terminus of the secondary period for most youth. Thousands of youth today leave high school and home to pursue courses ill-suited to their needs, interests, and capacities at universities that send them home as failures at the end of one, two, three, or four semesters. More could be done for these youth and done better through vocational specialization on the home ground through vocational courses and actual job connections following a proper grounding in the applied practical course of the three-M type herein described. This points clearly to the need of better guidance for youth in our secondary schools regarding occupational opportunities, occupational requirements, and needed educational and vocational preparation of all youth who ultimately must secure employment.

At the same time we must recognize, just as the three R's support academic and vocational activities, so, too, do the three M's have a double function. The same grounding in the three M's that plays so important a part in vocational adjustment will also add great breadth of understanding to the student who can pursue his college or university work satisfactorily. For him the experience in the industrial laboratory will provide cultural enrichment by giving meaning to the strictly academic subjects.

In this connection it should be kept in mind that the three R's in the elementary school and the three M's in the secondary school, strengthened by lateral support from all the other subjects offered at the various levels need to be so arranged and ordered that the roots for much that is offered on the secondary level may take hold in the soil of the elementary school. Thus, to cite but one example, occupational understanding can be systematically developed from the early grades up, in simple incidental fashion at first, but later along more extensive and intensive lines in the occupations classes of the upper grades. Proper grading is all important in arranging sequences in all areas of instruction.

In conclusion, may I say, that the transition to the more adequate curriculum I have discussed does not require a violent treatment of our present offerings. The transition will necessarily be slow and we will continue to offer in our schools much of the old as we introduce the new, better suited, more applied, and more vital curriculum. In doing so, we shall have to expect to do much cutting, fitting, and experimenting, not only in determining the curriculum content, but in improving our professional methods so that maximal results may be achieved. In the long run we shall gradually improve our facilities, our offerings, and our methods, and thereby serve the youth of the community better.

The Colored Student in Our High Schools

J. I. SOWERS*

The model plane shown here was made by the Booker T. Washington School, Miami, Fla. It is a Bahu Geki Ki-99, Japanese Navy Dive Bomber. The actual plane has a wing span of 47 ft. and a length of 35 ft. 3 in. In the scale model the wing span is slightly less than 8 in.

High schools in each of the 48 states are working hard to complete the government request for 500,000 model planes of 50 different types as used in all nations engaged in this war. These small-scale models will find many uses in army, navy, and civilian war work. More than this, the work in these model planes will make our youth familiar with this arm of the fighting force. Because of its newness as a fighting unit, the highly diversified types of planes used, and the technical language

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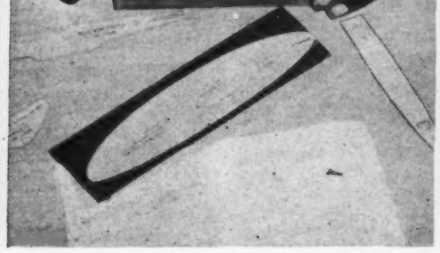
Plans and materials for making planes



Marking out the fuselage on the wood from template

Cutting out the fuselage on a band saw

Sanding the fuselage

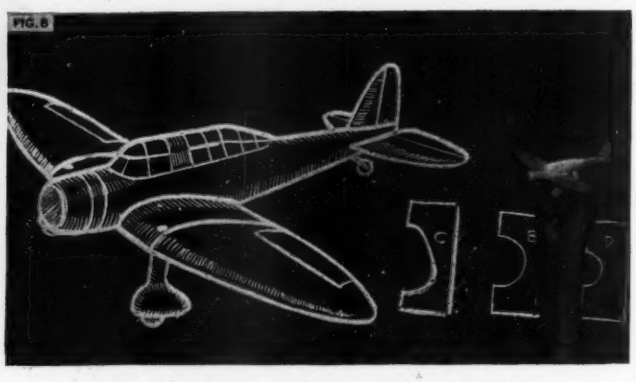
Using the templates to test for accuracy

Fitting fuselage and wings together

necessary, the aeronautics division of the navy is not yet so well understood as are the older types of combat forces. The making of these model planes is a fascinating work for both teachers and students.

The Booker T. Washington High School is one of the large and influential colored high schools of the south. While it offers the regular required high school courses, it is largely industrial in nature, offering courses in tailoring, carpentry, electricity, masonry, drafting, architecture, estimating, brick and block laying, automobile work, and painting, all taught by practical workmen teachers on a trade basis. The school is also outstanding in colored athletics in the south. Its former graduates present a long list of outstanding people in the fields of industry and some also in music and the professions. One of the winners of the Major Bowes program some time since was a singer trained in this school. The school has also made a large contribution to our armed forces, some as instructors and others in combat units. Nathan Wiley, an aviator and a former student, is now with the flying forces somewhere in north Africa. Many graduates from this school are doing their bit toward the advancement of civilization.

Gluing the elevator to the fuselage



Comparing the completed model with the sketch on the blackboard

The Men Behind the Men Behind the Guns

ISADORE M. FENN*

Vocational education is essential in preparing every individual to best utilize his own abilities in the present crisis, thereby insuring the safety of our great nation.

During peacetimes, the purpose of all activity of our industrial world is to supply the human being with sufficient social needs such as food, clothing, and shelter; but during wartimes, our industries must not only supply sufficient social needs, but also produce enormous quantities of military equipment and supplies.

In this present war crisis, in order for our country to be victorious, our industries need trained workers who can read, understand, write, and compute correctly. As we need millions of qualified workers with diversified abilities to play varying roles in our industrial world it is most imperative that each individual receive the best theoretical and practical training so that he may most efficiently execute his job in the particular field of work which meets his distinctive needs and make him a well-trained and acceptable producer.

Years of experience in setting up an operating vocational training program has prepared vocational education for this present situation. Trade and vocational schools and other available plant and equipment facilities are being utilized to the utmost. Vocational teachers, supervisors, and administrators are gladly accepting the great task of defense training.

*Tilden Technical Defense School, Chicago, Ill.

Many schools are on a three-shift basis and are open all day and all night.

Workers anxious to be trained in various skills in vocational defense courses are coming from public employment offices, WPA and NYA, CCC Camps, industry, city, town, and farm. Unemployed workers who are skill rusty through lack of work are being retrained through pre-employment-refresher defense courses. Workers already employed, but who wish to equip themselves for better jobs are receiving supplementary defense training. Out-of-school city, town, and farm youth, between the ages of 17 and 24, are receiving elementary defense training. Qualified enrollees are also receiving training in engineering defense courses of college grade.

Planning of defense training throughout our nation is being done by state and local advisory committees, assisted by the United States Employment Service, WPA, NYA, CCC, PTA, craft representatives, and other consultants.

The vocational defense training program is the world's largest and most efficient vocational training institution which America has been building for about 25 years.

The Smith-Hughes Act of 1917 created the Federal Board for Vocational Education and authorized appropriations to provide for the promotion of vocational education. The Smith-Fess Act of 1920, authorized appropriations for promotion of vocational rehabilitation of disabled civilians. The George-Ellzey Act of 1934, and the George-Deen Act of 1936 authorized additional appropriations for further development of vocational education in the states and territories.

In 1939, over 715,000 American youth were enrolled in vocational-education courses; over 535,000 youth were enrolled in vocational-agriculture courses; and 90,000 were enrolled in business and distributive education.

On June 27, 1940, Congress appropriated $15,000,000 for defense training in public vocational schools. In a short period of time 100,000 workers were enrolled for vocational-defense training. Because of an even greater demand for vocational education throughout the United States, Congress, in October, 1940, set forth an additional appropriation of $61,500,000. By March, 1941, approximately half a million workers were in defense training classes and by June 30, 1941, about 1,565,000 workers received training through courses in public vocational schools for work in defense industries.

As a result of America's 25-year investment in vocational education and through the untiring cooperation of federal, state, and local defense organizations, the present-day vocational defense training program is giving necessary vocational training to millions of workers.

From this well-planned program, our industrial world can expect a steady supply of skillful workers for the production of sufficient social needs, and essential war materials and supplies.

The growing demands of wartimes will be met by our great army of well-trained workers — the men behind the men behind the guns — and victory will be ours. Acknowledgment is hereby made to the American Vocational Association, Inc., Journal, July, 1941, *Vocational Defense Training* (Special Ed.), for material used in this article.

Streamlining Advisement for War and Peace

R. T. CRAIGO*

At no time since the founding of this country has there been such an acute need for advisement (counseling and guidance). For many years those of us connected with industrial education, including both industrial-arts and trade and industrial work, have felt that of all members of the instructional staff of any school, we in the industrial department know what it is to go and get a job, hold a job, and get *hired and fired*. Furthermore, most of us have had to deal with the material side of life rather than the theoretical or cultural side. At the present time those of us in industrial education are right *in clover*.

The impact of the present war and its many ramifications call for new or additional concepts in the field of advisement. Selective service is calling all men from 20 to 44; furthermore, there are strong probabilities that selective service may go down to include the 18-year-old youth. The situation becomes more serious when we assume that if the present war lasts at least two years longer, we are then down to the 16-year-old level, including those who must prepare for developments which will materialize when they become 18.

We are confronted with two basic objectives: winning the present war and meeting new problems in the peacetime following this war.

What is advisement? Most of us agree that advisement, guidance, or counseling calls for a study or knowledge of occupations, a fair comprehension of the qualifications of the individual, and a fairly clear picture of job specifications so that we can better fit the individual into one of the satisfactory fields of employment.

Looking at it in a larger way, advisement is one of the three steps of occupational adjustment. Occupational adjustment involves: first, advising people; second, training people; and third, placing people.

During the present critical times the picture is made more complicated by the fact that occupational adjustment involving military requirements may or may not fit into occupational adjustment when we get back to peace times, unless we carefully *watch our curves*.

It is becoming increasingly clear that this is a mechanical war and our advisement procedure should make allowance for certain resulting conditions. The machinery of war calls for two general types of training, technical and mechanical. Those interested in technical training should carefully consider engineering colleges in as much as this is the field in which they best function.

On the other hand, when we come to mechanical training we are vitally interested in industrial arts, trade and industrial training, and trade school activities.

It is also very desirable that in our advisement program we keep in mind that mechanical equipment used in war calls for three general classifications, namely, manufacturing, repair and maintenance, and operation. For example, tanks, planes and ships must be made in *manufacturing* plants. When these pieces of equipment are engaged in military activities, there is an increasingly heavy demand for *repair and maintenance* work. During actual hostilities all of this mechanical equipment must be *operated*.

All of the nations at war have already put forth a great deal of careful thought on activities following the termination of hostilities. In other words, the phrase "In times of peace, prepare for war" is changed around to "In times of war, prepare for peace."

Schools are earnestly endeavoring to develop and expand their advisement programs to allow for these situations.

At the present time training is being carried on under the classifications of de-

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fense training and ordnance plant training. This instruction in many departments is being given 24 hours a day and will probably continue for the duration of the war.

Beginning this fall when the 1942–43 school year opens, in addition to an expanded program of defense training and ordnance plant training, many schools will continue to operate their so-called *civilian or regular activities.* These latter are primarily intended for peacetime pursuits, but at the same time it is well to keep in mind that many of the peacetime pursuits parallel and merge into wartime pursuits.

No matter whether a student in the machine shop is trained to operate a lathe, to make an automobile part, or to make a part of a tank, the training content, procedure, and methods are identical.

It is well for young men to have in mind that it is advantageous in many cases to carry on vocational training even if later on the student expects to be called into military service, because if a student has the proper qualifications and is efficient in his training progress and is then called into military service he may be assigned to a mechanical branch of the service in which his ability and training will best function and at the same time be of greatest service both to himself and to his country.

It would seem highly desirable that the entire advisement procedure be carefully revised to make necessary allowances for the problems set forth in this article.

Planning the Arts Department in the Secondary School

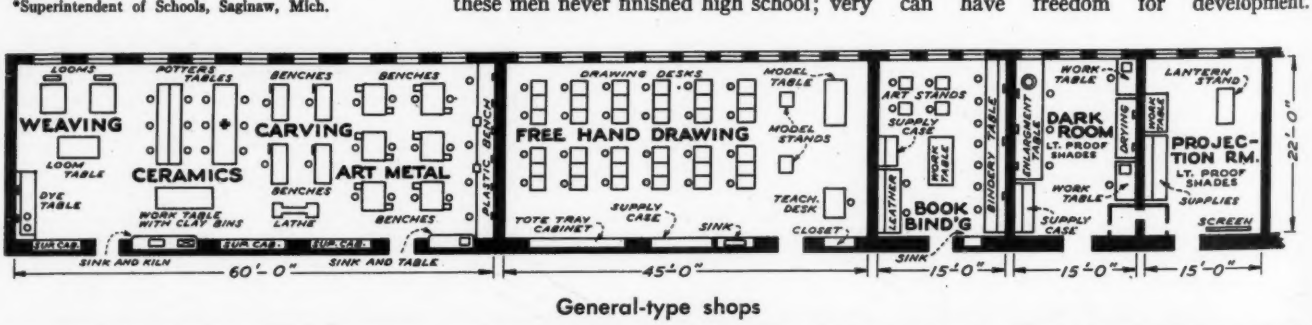
Chester F. MILLER*

In planning the community school secondary plant, the section of the building set aside for the arts will be interpreted as including creative vocational and avocational pursuits. The de-skilling of practically all industrial operations has placed the workman in the position of using his vocation only as a livelihood. The machine in mass production has become so efficient and such a component part of large scale operations that the workman has little, if any, opportunity to use his creative ability. This increasing tendency to standardize removes the premium on creative ability which was an incentive during the developmental stages of manufacturing in this country. This tendency in time can destroy the creative ability of our people. In recent years, we have known scores of men, working on the *production line* or operating a machine all day, who rush home to their basement hobby shops to do some real creative work.

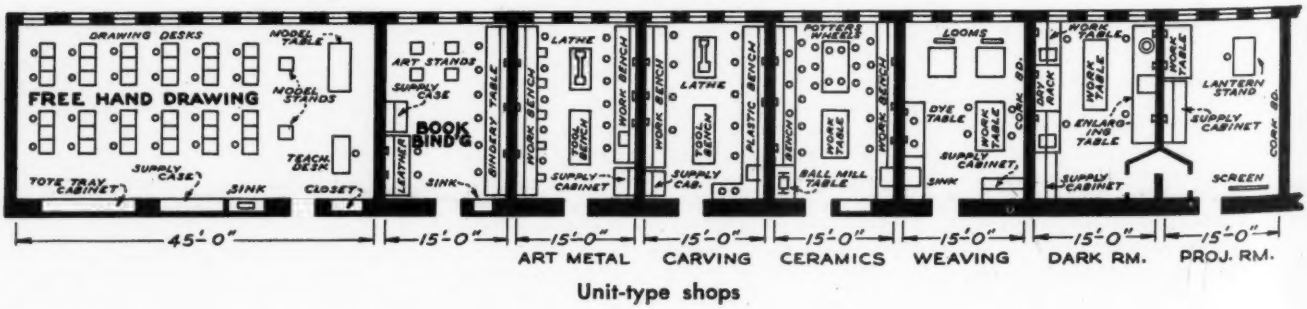
Having been responsible for the administration of schools in a highly industrialized section of the country for years has led to certain conclusions not so common in educational thinking. No doubt some of my colleagues will think I have gone *lowbrow.* It is my firm conviction that the old education was not what its braggarts claim. We have many who succeeded in spite of it, but the great success in the creative industrial field has come largely from those who refused to be regimented by it. It is most fortunate that Ford, Edison, and a host of others did not have their creative ability deadened by regimentation in the schools.

We number among our friends the heads of many large industrial plants. Many of these men never finished high school; very seldom is one a college graduate. In talking the situation over with them, we usually get the answer that engineers and college-trained men are cheap, but men with superior executive ability regardless of educational training are expensive. Why has school training so often killed executive and creative ability? Can we believe that the people without executive ability and creative ability are the ones who seek an education? We knew one of our greatest cartoonists who was repeatedly expelled from school for his creative ability. Fortunately, he resisted parental persuasion and school regimentation to become a great creative artist through his own efforts. All of this causes us to question our plan of instruction. We would not change the requirements for basic training; in fact, we would broaden them. We do advocate a place in the school where creative ability can have freedom for development.

*Superintendent of Schools, Saginaw, Mich.



General-type shops



Unit-type shops

Through the medium of this intensive interest, we would engender the need for basic subject matter as a means of realizing the fruition of creative ability.

In our shops a high school student named Hoskins played around with a creative idea and developed a knurled washer now manufactured by the billions as standard equipment on radios, automobiles, airplanes, etc. Another student developed small steel cutters for making fine precision instruments, such as dental tools. He is now building a large plant and has over 150 employees — all young men. We now have large classes of school-trained engineers who are trying to salvage their creative ability and become tool designers.

The joy of creating must be brought back not only to the students in the schools but to the adults. After all, the great bottlenecks in the present defense program have been caused by the great shortage in tool designers and others in the creative end of industry. Creative designing has done more to give the United States leadership than any other phase of industry. Many of these designers were foreign born. We must now supply our own.

In the designing of a secondary school, the arts section should be so located that it will be available for use of adults when any or all units are not in use by the school. The central unit should be what we shall call the freehand drawing room. Through this room, groups can receive preliminary training and do their planning and designing before proceeding to the different craft units.

We are suggesting two layouts occupying the same floor space and including the same creative arts. Some educational programs desire the large general-type room where groups may work in different parts of the room on equipment best adapted to their work. Others desire the small craft room, specially fitted for the specialized craft. The latter may have some problems of supervision. If desired, double glass soundproof partitions may be erected between the rooms. This plan makes visible the operations in all rooms. With our present plan of instruction, this is not at all necessary. Students are intensely interested in this creative work which eliminates disciplinary problems. A well-organized craft plan has an advanced student in charge of the group to assist students with the work. If these shops are organized somewhat on the Dean plan, the cost of instruction will be no greater on the individual shop plan than by the general plan.

We have reproduced here the general plans which have been in use in our new high school for over a year. It is from our experience with this plan that we propose the unit rooms. The general plan works wonderfully well with high school students and is all that we desire. The general plan is not as effective when the department has adult use. Adult use is more concentrated. The adult desires to work in a more limited field. Using the unit shop is not as expensive for out-of-school adult use. It simplifies supervision and permits the adult to work undisturbed on his own problem.

The rooms we have suggested can be made adaptable for several creative arts not mentioned. We are proposing a photography unit. Today there is no greater interest as a hobby, an avocation, or even as a vocation. Recent advancements and universal interest in this field really commend it as part of the school curriculum. We would go so far as a darkroom for developing films and reels. We would propose a projection room, a display room where the activities of both school and adult camera club activities could center.

Both plans conform to a building using the 15-ft. construction unit as a base. Each plan shows only the most important items of equipment. There are many other items which should be included in a more comprehensive plan. Most of the equipment has been held to the bench-type, because it is suggested that sides of the room be glass for supervision. The question of hand and portable electric tools for bookbinding, metal crafts, carving, and plastics is going to depend on the wise selection of only tools used continuously. Only limited equipment is suggested because the idea of the shops is creative and limited equipment develops ingenuity. Sinks should be located in each unit.

Each room should be equipped with convenient outlets along the benches and worktable tops, gas for crucibles, electricity and/or gas for dyeing kettles.

Our estimate of the general plan is $5,000; the unit plan, $6,000. These prices do not include small hand and portable electric tools.

A preview of the future of the creative arts is based on present trends. Undoubtedly, the vocational emphasis, the mechanization of war, the move toward mass production, and the public consciousness of the machine in our civilization will place greater emphasis on the creative arts in both the school program and the program of adult education.

WORK EXPERIENCE AT LOS GATOS UNION HIGH SCHOOL

WM. E. HUFF*

The faculty at Los Gatos Union High School felt that plans could be worked out whereby the school and the community could cooperate in educating youth. A local contractor was approached with the suggestion about such a plan. Two boys would have their school schedules reorganized so that they could leave school by noon and spend the afternoon working with the contractor on house construction. It was agreed that these boys would not be used merely as roustabouts, and that not more than 25 per cent of their time would be spent on any one job. The boys were scheduled to work a total of 180 hours on this project. They write weekly reports describing each day's work, and illustrating with sketches the jobs done. Each week, when the reports are turned in, the instructor reads the reports and discusses the work with the boys. Frequently they are asked to find out more about certain phases of the work and to report on them at a later date.

After the boys have finished this project, they will draw the plans, write the specifications, and make a perspective drawing of a house. For this they will receive a credit in their architectural drawing.

So far the contractor has been well satisfied with the experiment and the boys are enthusiastic over it. They feel they are having a valuable experience.

Such a program of work experience is capable of wide application. Pupils may receive training in skilled trades, salesmanship, secretarial work, and technical pursuits. The practical training creates interest, gives the pupil work experience, and is helpful in vocational guidance.

At the present time similar programs can be an aid in national defense. The schools of Santa Clara County, Calif., in which Los Gatos Union High School is situated, are cooperating with the farmers to overcome the labor shortage by furnishing pupils with farm experience to work on farms part time under adequate school supervision.

*Los Gatos, Calif.

Superintendent Dickson of Berkeley, Calif., suggests this to the school children:

"In case of an air-raid warning while you are on your way to or from school, ring the doorbell of the nearest residence and ask to be taken in, or go to the nearest store or other building for shelter."

He asks the cooperation of parents and residents in case any child should come to the door. Parents are also requested to see that every child has his name, address, and telephone number on his person at all times.

Correction does much, but encouragement does more. Encouragement after censure is as the sun after a shower.

— *Goethe*

INDUSTRIAL ARTS AND VOCATIONAL EDUCATION

John J. Metz, Editor

The Need for Industrial Arts and Vocational Education

It is very encouraging to all friends of industrial arts and vocational education that more and more school superintendents are beginning to realize that industrial arts has a vital duty to perform in the education of modern youth. Unfortunately, this awakening is extremely slow. Too many of the dyed-in-the-wool academicians, who so often are the heads of the educational systems in our school systems, still have but a vague understanding of the terms *industrial arts, vocational guidance,* and *vocational education.* That these very people are still groping about in the dark may be largely attributable to the industrial-arts teachers themselves. True, some of our leaders have preached the necessity of giving this phase of education an increasing amount of emphasis commensurate with the clearly apparent needs of our scientific-mechanical age.

Unfortunately, however, many of the educational administrators failed to be impressed or even interested. There are some, who, even under present conditions, think that general education can go on as usual. They seem unconcerned about the pressing need of reorganizing our secondary education so that it will exert a greater influence in the lives of the youth now found in our schools.

Even before the present emergency demonstrated the fact that trained skilled and semiskilled workers were dangerously lacking throughout our country, few educational administrators saw the need for doing anything to remedy this condition. They knew that approximately two million high school students would graduate each year. They also knew that only about one fourth of these would go on to college, while a large percentage of the rest just had to be content to wait for some kind of job opportunity to come their way.

Many of these graduates had little conception of what kind of work was demanded of workers in business and industry. Well-developed industrial-arts courses would have given these young people at least some knowledge of how workers make a living, what kind of work they do, what tools they use and how they use them, how different kinds of materials are used for varying purposes, and what is expected of men working in certain occupations.

Today, of course, many people who have never had industrial-arts work at school, get intensive training which fits them, for the time being, into the role of the semiskilled laborer. But even in these training courses, it has been found that those who had industrial-arts courses while at school can be trained better and quicker than those who have never had the opportunity for taking school shopwork.

Several hundred thousands of radio, household appliance, and car salesmen, have recently been added to the civilian war casualties. Many of these have been quite successful as salesmen, but they are now stranded because they possess no skills or knowledge which can be adapted to present industrial needs.

It is time then that our educational administrators be aroused to the need of the times. They must be shown that industrial arts and vocational education have a definite part to play in the general education of a large number, if not all, of those who attend school. It is the duty of every teacher of industrial arts and vocational education to spread this gospel at all times.

It should not be forgotten, however, that every teacher of industrial arts and vocational education also has another duty, and that is to improve his work continually so that it will better achieve the objectives that have been set up for it, and so that it will exert a more effective influence in the lives of our young people.

Thirteen Pairs of Eyes

The April issue of the *Philosopher,* published by the Kalamazoo Vegetable Parchment Co., carried a little story under the same name given to this editorial which ought to strike a responsive chord in the heart of every teacher.

A boy leader asked each of 65 boys in his group to write the name of the man whom he admired most, and whom he wanted to copy in his own life, on a piece of paper and to hand it to him at the end of the meeting.

A study of the papers showed that the largest number of boys chose their own fathers as their model, but there was a goodly number of votes cast for other men, too. The one who got the most was a neighborhood hardware dealer.

When this man was informed of the fact that thirteen out of 65 boys had chosen him as their model of a real man, he became considerably perturbed.

"Why," he said, "this is too great a responsibility to load onto me. While those boys have shown me the highest honor that has ever come to me, they also impose the duty that I must henceforth consider every one of my actions as though 13 pairs of eyes were watching me. I must always think about whether the things that I do would make those 13 boys better or worse if they imitated me. I must never do anything that will destroy their confidence in me."

Has this story any implications for the teacher? Has it any for me and for you personally?

The Need for Emphasizing Fundamentals

The Navy has a standard arithmetic test which it gives to the new recruits who enter the navy's vocational schools. This test is comparatively simple. It is merely a review of the fundamental arithmetical operations of addition, subtraction, multiplication, and division, as applied to whole numbers, fractions, and decimals. There are several problems in denominate numbers, one asking how many cubic inches are in four cubic yards, and one on square root. No thought problems were included in the tests given to 3052 recruits during the months of November and December of 1941.

The facts disclosed are not flattering for those of us who belong to the teaching fraternity, for the average for the whole group was but 44.2 per cent.

Two of the entrants had seven years of college work to their credit, but their average test was 62.5 per cent. The 10 men who had three years of college work stood highest in the test. Their average was 80.5 per cent. The 799 twelfth graders earned an average of 56.1 per cent, while the 475 eighth graders achieved an average of but 30 per cent.

Results such as these seem almost unbelievable, yet they are taken from publicity material issued by the navy.

The conclusions to be drawn seem to point to the fact that fundamentals are not stressed enough. Some of the educa-

tors who want to dispense with all examinations might also learn that the product of the school is tested in life and that our students had better become accustomed in school to know that examinations, while nerve racking, are nevertheless essential to show what one has or has not acquired from his educational work.

Vacation Notes

Vacation months should be happy months. Unfortunately, they are turned into sorrow for many because of accidents. Students should be warned of the many things which must be avoided if the frightful toll of summer accidents is to be kept down to a minimum. Teachers, too, will do well to keep these admonitions in mind, because long experience has shown that even experts, who thoroughly know dangers and how to circumvent them, may in a thoughtless moment, fall victim to the ever watchful imp who deals out accidents to those who least expect them.

To make the 1942 vacation a happy one, be temperate in all you do. Do not strain yourself by playing, hiking, swimming, rowing, or exercise too hard or too long; drive carefully and not too fast. Start early enough and there will be no need for extreme hurry.

Swimming is great fun and fine exercise. There are some who can go into the water right after a meal and feel no ill effects. Nothing evil will befall you if you do not follow their practice. Give your digestive organs a chance to work before you go swimming.

Be careful when you dive. The surface of the water may be fine, but unless you know what is beneath it, do a little exploring before you dive.

Learn lifesaving methods. You may be helpful to others. Do not attempt to save a drowning person by swimming out to him, unless you can get no boat to reach him in time. Do not cry for help while in the water unless you really need help.

Step into the middle of a boat when getting aboard. Don't stand up in the boat unless you use every precaution so as not to have an upset. Do not rock the boat. Many boat rockers have drowned others and themselves with this particular, perverted, type of humor.

Do not expose your body for too long a period of time to the direct rays of the sun. Ten to fifteen minutes of such exposure may be long enough for the first day. Later on you may be able to stand more. A wet skin is more susceptible to the rays of the sun. Wear a hat when in the sun, and thus avoid a sunstroke.

When fishing wear sufficient clothing to protect yourself against the sun and against insect bites. Carry drinking water rather than run chances of poisoning yourself by drinking unboiled river or lake water.

Be careful of scratches and punctures of the skin. Apply first-aid remedies at once. Acquaint yourself with the appearance of such plants as poison ivy, sumac, and the like.

If you have touched such a plant wash in several changes of soap and hot water. Don't use a hand brush for this ablution. Finally, have your clothes dry cleaned if they were in contact with the poison plants.

Be careful and enjoy your vacation.

The Seeing Eye

With the induction of large numbers of new and frequently inexperienced workers into the factories working on wartime products, it is more necessary than ever that the teachers who train these men instill into them not only skills but also safe working attitudes and habits.

Accidents not only cause pain, worry, and loss of time and money, but they also may carry in their wake permanent disability, and frequently death.

Accidents to the eyes of workers are the cause of much lost time. Statistics show that eye accidents alone cost industry 9,455,000 man days during 1941. How much this time would have helped in furthering our victory war effort can readily be seen.

Harry Guilbert, safety director of the Pullman Company, in addressing the Pittsburgh Optometric Society, stated that industrial accidents in our country cause the destruction of 2000 eyes annually.

That little has been accomplished in reducing this type of occupational accident is shown by another set of statistical facts gathered by the Industrial Commission of Ohio. This organization reported that in 1926, out of a total of 220,785 injury and occupational disease claims, 43,038 were for injuries to the eye. This means that 19.5 per cent of these time-robbing claims were for eye injuries alone.

In 1940, a total of 209,127 claims were filed. Out of these 40,772 were for eye injuries. This again is 19.5 per cent of the total. A further significant fact is that out of the 40,772 eye injuries, 35,236 of them were caused by cuts, lacerations, punctures, or by flying objects.

Fifteen years of safety-education experience seemingly has not sufficed to make workers more safety conscious as far as eye protection is concerned.

Again quoting from Harry Guilbert's address, 80,000 persons in the United States today have lost one eye in industrial accidents. Eight thousand more have lost both eyes. And the total monetary cost to industry in compensation and medical care for eye accidents amounts annually to approximately $100,000,000. The tremendous monetary loss to the workers who suffered these eye injuries, to say nothing of the pain and inconveniences experienced, can only be guessed at.

Mr. Guilbert pointed out with justifiable pride that the Pullman Company had succeeded in practically eliminating the common causes of eye injuries, and that they had but two workers in 12 years who lost an eye while at work. This is a remarkable showing considering the fact that the average pay roll of this firm embraces 25,000 persons.

One reads with interest how cleverly seeing-eye dogs take care of their charges, but it should not be forgotten that the best seeing eyes are the ones in their own individual sockets, aiding the worker who means so much to this country right now, in doing his part in the production work which will help America to carry this frightful war to a victorious conclusion.

"The Idea of what is true Merit, should also be often presented to Youth, explain'd and impress'd on their Minds, as consisting in an Inclination join'd with an Ability to serve Mankind, one's Country, Friends, and Family; which Ability is (with the Blessing of God) to be acquir'd or greatly increas'd by true Learning; and should indeed be the great Aim and End of all Learning."

— *Benjamin Franklin*

Character is higher than intellect. A great soul will be strong to live as well as to think.

— *Emerson*

Channels of Choice

DEAN M. SCHWEICKHARD*

An Age-Old Question

In one of the oldest and most widely known books in the world there is written: "Choose you this day whom ye will serve." This statement made as an early religious admonition applies equally well in numerous other times and circumstances. The necessity for choice has followed man throughout his history and will continue to cling to him wherever he goes.

One of the greatest choices of all lies in distinguishing between the *important* and the *trivial;* between that which deserves deep consideration and that which can be decided lightly. One significant sign of limited comprehension is to ponder long over insignificant things, or to hang too long on unimportant details in seeking the choice that leads to a decision.

Another sign just as significant is to make too hasty a decision on important matters without due consideration to the factors involved. Either extreme is an indication of the improper or inequitable comparison of values; but the middle ground is the one which is often difficult to find.

The question of a wise choice is frequently made more complex by the fact that the choice does not always involve the task of differentiating between two things of obviously different nature such as black and white, night and day, or vice and virtue. Many times the choice lies between two highly desirable things, to forego either of which seems like a sacrifice. The question then becomes: "Which is more desirable?" Or it may lie between two undesirable, disagreeable, or unpleasant things, and the question becomes: "Which one is less distasteful?"

Thus a disagreeable path or course of procedure may be followed to avoid the possibility or probability of something worse; or an obvious benefit may be foregone in order that a greater one may be enjoyed. Each individual choice can be made more wisely if it is considered, not as an isolated matter, but one which has to do with the ends or purposes toward which the total energies of life may be devoted.

Focus of the Present

One glance down the counter of a modern cafeteria might lead to the supposition that the inventor of that means of dispensing food had made a deliberate attempt to add to man's ever present problem of choice. As a matter of fact he merely brought it to a focus. The present-day world has created many opportunities for choice, has retained many which have always existed, and has shed a few peculiar to circumstances of former generations.

There still are and always will be friends to be chosen, life partners to be selected, churches to be preferred, and vocations to be decided upon. There continues to be the necessity for choosing between selfishness and altruism, between material advantage and principle, between turning back and going on in time of adversity, and even between life and death, or the giving of one's life that other life may be possible.

The school as a democratic institution offers numerous occasions for choice. The successful operation of a school or a school system depends upon: the people's choice of a school board; the board's choice of a superintendent; and the superintendent's choice of his staff of assistants, directors, supervisors, principals, teachers, janitors, and clerks. The special departments of art, music, home economics, and industrial arts offer a wealth of opportunity for the exercise of free choice as to materials and mediums of expression.

Beside all the choices a parent must make for himself, he is faced with a myriad of choices for his children. When they are disobedient or unruly, he must decide what form of punishment will be most corrective. He must decide what privileges are wise and what indulgences are discreet. It is his responsibility to choose between the things which may be classed as necessities and those which are less essential. Putting all these decisions into the hands of the parent may seem autocratic, but there still remains plenty of scope for the choices of the child, and the parent may help to realize the highest goals for his child by exercising intelligent guidance in the essential avenues of choice.

If the parent or teacher has been able to make the kind of choices for himself which have brought contentment and satisfaction, he will be able to offer some light on the basis for determining choices and to point to the ones which are likely to be most helpful and stable. Factors which frequently enter in are: personal liking or desire; financial gain or limitation; past promises; notoriety; popularity; revenge; jealousy; ultimate satisfaction to be derived; defense of a principle; and service to fellow man.

The close of a school year and the approach of summer vacation present the necessity for choices to both teacher and pupil. The most fundamental question is: "How shall the summer be spent to advantage?" The answer will depend upon the purpose to be sought and the end to be gained. It may be health and renewed strength, added income, supplemental education, work at home, or service abroad.

In many a year the question at the beginning of summer has been: "Where shall I look for a job?" but this year it is more likely to be, "Which job or line of work shall I take?" The choice of a school for summer schoolwork may have disappeared entirely from many minds for this summer because of so many other pressing questions and choices. As conditions in the world change, there come modifications in the areas from which we choose.

The Choice Supreme

The entry of the nation into war has changed the real and anticipated mode of living for most people in the active years of life, and has thrust into vivid perspective many new channels of choice. Students who have finished part of a course of education are asking themselves: "How far is it wise to interrupt a school course to enter military service, when I may prepare to be of greater service by continuing?" The person out of school may be trying to decide when it is time to change from his former or normal way of life to enter a specific war service.

The question which confronts every red-blooded loyal American is: "Where can I best serve to help win the cause for which my country is fighting?" In the great contrast between high wages and comparative safety on one hand and low pay for active military duty on the other, this choice is often difficult to make.

It sometimes appears that principle has been subjugated to the material in the evident strife for wealth, the desire for conveniences, the increase of luxuries, and the quest for ease. In this hour of struggle, however, it is evident the civilized peoples of the world are ready to cast in their wealth, their possessions, and their very lives — all to be destroyed if need be in order that there may be preserved man's inalienable right to choose his own destiny before his God without the curse of an intervening dictator.

The soldier in a conquering army may find it easy to despoil the conquered inhabitants and plunder their possessions, but the victory becomes of much more priceless worth if the victor continues to observe the principles of humanity which threw him into the struggle. When victory comes we will need to remember that the responsibility for a *wise* choice of procedure weighs more heavily upon the victor than upon the vanquished. May we choose the course now which will hasten the day of a well-earned victory, and when it comes may we be guided to follow the channels of choice which will make it last.

*Assistant Superintendent of Schools, Minneapolis, Minn.

Developing Good Work Habits and Attitudes

ALBERT E. JOCHEN*

Of late there has been a great deal said concerning character building and the wholesome personality. The books are legion that offer suggestions on how to develop a personality that will completely captivate all with whom one comes in contact.

That a fine personality is an asset no one will deny. We in education, especially those in vocational education, are well acquainted with the fact that job failure is more often due to personality defects than to a lack of technical or manipulative skills. Vocational education is acutely aware of this problem because its success or failure largely depends upon how well its graduates succeed in industry. The building of good work habits and attitudes is one of the major problems of education.

As educators we are also aware of the difficulties involved in attempting to provide a tangible program of personality development. An individual's personality is not made up of a number of specific factors which, after being isolated, measured and analyzed, can be reassembled into one complete whole. This complexity of personality and its development has caused many of us to side step the problem of personality training. We excuse ourselves by saying that all good teachers are always developing desirable traits in their students. No doubt this is true; yet, in the writer's opinion, it is no valid reason for not attempting a definite, tangible program of personality development which reaches the individual and makes him aware of his weak and strong points. Individual awareness is essential, since one of the first principles of learning recognizes the fact that a realization of one's progress or lack of it is a definite stimulus in the improvement of learning. Teaching, to be effective, must be definite; it must be planned. The building of good work habits and attitudes cannot effectively take place unless the school system recognizes the traits it wishes to build, and exercises as much care in nurturing them as it does all its other subjects.

The vocational school can, with little difficulty, learn which work habits and attitudes are considered desirable by industry from a study of the employee rating sheets used by the industries employing their students. Personnel departments in industry have been using various rating systems for many years to measure work habits and attitudes, and their experiences with the problem are of value to the educator who would try to develop good work habits and attitudes.

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Industrial Employee Appraisal Sheets

A study of a number of employee appraisal sheets reveals the fact that while there are differences in minor details, the majority are alike in that they are interested in such items as:

STUDENT APPRAISAL SHEET

Name Willie Doe Class Painting Date March 3, 1941

Rated by Albert E. Jochen Score 32

Accuracy of shop and classwork		Ability to act as a leader	
1. Makes many errors		1. Very dictatorial	✓
2. Is careless	✓	2. Hinders	
3. Is fairly accurate		3. Fair	
4. Is careful		4. Good	
5. Is very accurate		5. Excellent leader	
Care of working space		Attendance	
1. Very untidy		1. Off a great deal without valid reason	
2. Careless	✓	2. Off occasionally without valid reason	
3. Just passable		3. Off occasionally with valid reason	✓
4. Keeps space clean		4. Seldom off	
5. Space very clean and orderly		5. Never late or tardy	
Handling of tools and equipment		Participation in extra activities	
1. Rough	✓	1. Doesn't take part	
2. Careless		2. Seldom takes part	
3. Indifferent		3. Fair degree of participation	✓
4. Careful		4. Good degree of participation	
5. Very careful		5. Cooperates willingly and cheerfully	
Speed in shop and classwork		Attitude toward fellow classmates	
1. Very slow	✓	1. Does not get along with them	
2. Slow		2. Looks down upon them	
3. Ordinary		3. Neutral	✓
4. Fast		4. Good	
5. Very fast		5. Very well liked by classmates	
Use of working time		Attitude toward teachers	
1. Very wasteful	✓	1. Disrespectful	
2. Loafs with others		2. Does not cooperate	
3. Passable		3. Average	
4. Busy		4. Cooperative, respectful	
5. Very busy		5. Very cooperative and helpful	
Use of materials		Observance of safety rules	
1. Wasteful	✓	1. Disregards rules openly	
2. Careless		2. Disregards rules when not watched	✓
3. Fair		3. Average	
4. Good		4. Observes rules	
5. Very careful		5. Observes rules and has his own	
Ability to learn		Personal appearance and cleanliness	
1. Dull		1. Slovenly and dirty	
2. Learns slowly	✓	2. Untidy	
3. Average		3. Fair	✓
4. Learns quickly		4. Neat and clean	
5. Brilliant		5. Exceptionally neat, clean	
Acceptance of responsibility		Initiative	
1. Refuses to accept it	✓	1. Doesn't exhibit any	
2. Evades responsibility		2. Very little	✓
3. Passable		3. Average	
4. Likes to be given responsibility		4. Offers many suggestions	
5. Seeks it and handles it well		5. Very original	

STUDENT APPRAISAL SHEET

Name John Doe Class Sheet metal Date February 14, 1941

Rated by Albert E. Jochen Total score 30

Quality	Put cross in section best describing student				
	Unsatisfactory negative qualities			Satisfactory positive qualities	
Accuracy of work	many errors 1 X	careless 2	passable 3	careful 4	most accurate 5
Care of working space	untidy 1	careless 2 X	passable 3	clean 4	very clean 5
Handling and use of tools, equipment, etc.	rough 1	clumsy 2 X	passable 3	careful 4	very careful 5
Speed of work in shop and class	very slow 1	slow 2 X	passable 3	fast 4	very fast 5
Use of working time	very wasteful 1 X	loafs with others 2	passable 3	good 4	always very busy 5
Ability to learn	dull 1	learns slowly 2 X	average 3	learns fast 4	brilliant 5
Acceptance of responsibility	evades it 1 X	accepts with protest 2	passable 3	likes it 4	likes it and seeks it 5
Initiative	exhibits none 1	exhibits little 2 X	average 3	good 4	superior 5
Attendance	habitual truant 1	poor 2	fair 3	good 4 X	perfect 5
Attitude toward school work	very poor 1	poor 2	neutral 3 X	good 4	wants to make good 5
Attitude toward classmates	doesn't get along 1	stays alone 2	passive 3 X	good 4	excellent spirit 5
Attitude toward teachers	disrespectful 1	does not cooperate 2	average 3 X	cooperates 4	excellent attitude 5
Personal appearance and cleanliness	very untidy 1	untidy 2 X	passable 3	neat 4	very neat 5
Observance of safety rules	disregard for them 1	needs watching 2 X	passable 3	good 4	excellent 5

1. Accuracy of production
2. Care of working space
3. Speed of production
4. Use of working time
5. Ability to learn
6. Handling and use of materials
7. Responsibility
8. Adaptability
9. Initiative
10. Attendance
11. Attitude toward job
12. Attitude toward fellow workers
13. Ability to direct the work of others
14. Attitude toward safety program

From a study of these items we can readily see why people today are so personality conscious — their job security, their advancement, and their pay depend upon these traits. Industry places a high premium upon good work habits and attitudes, and all workers, whether they work for a large or small concern, are rated according to some such standards.

Since industry and vocational education are interested in good work habits and attitudes, and since we in vocational education are training students for entrance in industry, then it seems logical that a program which makes the student aware of the traits desirable in industry, and which provides an opportunity to develop these traits, should be of service to the student, to the school, to industry, and to the community.

Let us adapt industry's program of employee appraisal to our school situation, and then let us as teaching experts bend our every effort to determine the most effective way of appraising and improving the work habits and attitudes of our pupils.

The student appraisal sheets illustrated in this article may serve as model rating sheets. If, however, you wish to design your own, contact the industries in your area and study the rating sheets in use. From these you can learn what traits are rated, and you will have a basis for developing a suitable appraisal sheet for evaluating student work habits and attitudes.

Once a suitable appraisal sheet has been designed, it then becomes necessary to set up an efficient method for introducing and using the appraisal sheet so that it doesn't become another cumbersome record to file in the *archives* where it is subjected to a series of periodic dustings until it is eventually *dusted out* to make room for new reports and records.

Just as the teacher when presenting a new lesson carefully lays the groundwork for the new material, so the students and teachers should receive the preparatory steps to the appraisal system. Good preparation for the appraisal program will cause both the students and the teachers to see the practical value of the appraisal sheet, and the spirit of mutual cooperation which is so essential to the success of the program is more likely to result.

The following outline may prove valuable as a guide for preparing the students and the teachers for the program:

Preparation of Teachers

1. The principal, together with a committee of teachers who are interested in the problem of personality improvement, should meet and plan a tentative program designed to build good work habits and attitudes. The program should be presented to the faculty for discussion and improvement.

2. Industrial appraisal sheets should be distributed among the teachers for discussion and study.

3. A bibliography of materials upon the subject of rating should be prepared and presented to the faculty. If possible, articles read should be presented to the faculty for discussion and general enlightenment.

4. Personnel directors of industry might be requested to describe their method of rating workers.

Preparation of the Students

1. Specific teachers should be assigned the duty of teaching the importance that industry places upon good work habits and attitudes.

a) Exhibits can be made of actual employee appraisal sheets used in industries close by, and the items listed upon these sheets can be analyzed and discussed in class.

b) Problems on the importance of good work habits in the home, school, industry, and community can be presented for class discussion.

c) Specific job failures of graduates can be analyzed and discussed.

d) Particular student problems can be presented and discussed.

Auditorium Programs

Auditorium programs can be made very instructive and practical if careful preparation is made which considers the objectives of each program and the methods to be used to achieve the objectives. The writer suggests that each program be carefully planned and that the entire series of programs be outlined sufficiently far ahead of presentation so that proper student preparation can be made in the classrooms before each program.

If speakers are to be part of the program, they should be given a definite topic and an outline of the points which they are to cover. They should be given a complete outline of all the topics to be discussed in the series so that they are aware of the total program and its objectives. In addition, they should receive a description of the school, its purpose and objectives; and a description of the audience, its age, background, and the like.

It is also suggested for topics such as those outlined, that the students know beforehand the name of the speaker, his background, and the topic that he will discuss. Although no attempt should be made *to steal the speaker's thunder,* the teachers in charge of familiarizing the students with the auditorium programs should, if possible, record any questions that students raise which might be asked of the speaker. Frequently a speaker is willing to answer questions after his talk. If these questions are prepared beforehand, they help to enliven the presentation for both speaker and audience. Definite time limits for speaking should also be established and made known to the speaker. If films are to be shown, they should be previewed beforehand. Oftentimes excellent titles reveal little or nothing of the contents of the film. If possible, all auditorium programs should be followed up in the classroom in order to clinch important points and to clear up debatable or vague points.

1. If possible, secure a state employment supervisor to speak upon the subject, "Who Are the Unemployed and Why Are They Unemployed?"

2. Get a practical man from industry to speak on the subject, "The Type of Young Worker Industry Wants."

3. Get a personnel director to describe his rating sheet and the value of having the qualities listed upon it. In the writer's school, a lantern slide was made of an employee appraisal sheet, and it was projected upon a screen.

4. If you have the facilities for projecting pictures, select a film that has to do with personality development.

5. Have students prepare and present short skits to illustrate good and poor work habits.

6. The principal or the director of guidance and placement might prepare and present a talk on the subject, "Which of the Graduating Students Are Selected for Jobs First, and Why?"

The final auditorium program should be in charge of the principal or director of guidance and placement who should emphasize again the value of possessing good work habits and attitudes. At this time he should also be prepared to explain his program for appraising student work habits and attitudes, and his plan for assisting the students in correcting bad work habits and attitudes.

Student Appraisal Procedure

The following student appraisal procedure is offered as a guide:

1. The teacher should rate any student who has been at least six weeks in his shop or class who he feels is outstanding in his lack of one or more of the desirable traits. Under no circumstances should one incident or an *off* day be the basis of a rating. Consistency in a trait or the lack of it should be the yardstick.

2. The rating sheet should be sent to the principal or guidance supervisor as soon as it is properly filled out.

3. The principal, or guidance supervisor, upon receipt of the student appraisal sheet, should request all teachers who get the student to rate the student and send the appraisal sheet to the office.

4. Upon receipt of all the appraisal sheets, the principal, or guidance supervisor, should prepare a composite sheet. With the composite sheet as a guide, the principal, or guidance supervisor, and the teachers who rated the student should meet and suggest a remedial program for the student.

5. After the remedial program has been worked out, the student should have a conference with the principal or with a teacher who has been assigned as his adviser. The adviser should tactfully review the ratings of the student and explain that although the student may not feel that he is the kind of person the rating sheet reveals, yet that is the way he is *selling* himself to others. It should also be explained that his teachers are very desirous of assisting him in building good work habits and attitudes so that when he graduates the school may recommend him for a job with the knowledge that he is not only carefully trained in technical and manipulative skills, but that he also has good work habits and attitudes.

6. Six weeks after the first interview, or a reasonable time thereafter, the teachers should appraise the student again. The ratings should be checked by the principal, and a conference should be held to determine what further steps should be taken to assist the student.

7. The pupil should again be called for a conference with the principal or his adviser and his progress or lack of it should be discussed. Of course, it is understood that the adviser is at all times aware of the progress of the students he is counseling, and that he is always available to these students.

8. This procedure should be continued until, in the judgment of the principal and the teachers, the student has remedied his deficiency or can no longer profit from the program.

Conclusions

While the writer is aware of the fact that mere student rating coupled with the cooperative efforts of a teaching staff to build good work habits and attitudes will not provide the answer to a teacher's prayer, nor will it prove effective in every case, yet effort spent in this direction should ultimately produce the following desirable results:

1. An effective student appraisal program will focus attention upon good work habits and attitudes, and both teachers and students will be more conscious of them and their importance in our daily life.

2. Individual and isolated efforts expended on the building of good work habits and attitudes will become cooperative and unified.

3. Students will be rated on their work habits and attitudes when they enter industry. Their ratings will determine their job security, their salary, their advancement. Familiarity with rating procedures and a knowledge of the traits which industry desires should help the prospective worker make better adjustments to actual industrial situations.

4. Since the *raison d'être* of vocational education is the training of a student to get a job, hold a job, and progress in a job; and since a lack of good work habits and attitudes prevents the achievement of these objectives, then we are obligated as vocational teachers to take whatever steps we can to assist the student in building good work habits and attitudes.

5. As educators we are aware of the growing demand for factual information and records on the part of industry concerning our students. We are also aware of the fact that industry has long been interested in employee appraisal. If through our student appraisal program we can show industrial personnel supervisors that we, too, are interested in their problem, we may develop closer contacts with industry and thus enable our graduates to be given preference.

6. The development of good work habits and attitudes in the individual should tend toward the development of personal self esteem and confidence which are so essential to the good mental hygiene of the worker.

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Finding Your Life Work, a film — 22 minutes, 16mm. sound. May be rented from Vocational Guidance Films Inc., Old Colony Building, Des Moines, Iowa.

Selling Graphic Arts to the Student

R. RANDOLPH KARCH*

Graphic arts progress, at least for the printing departments of the vocational schools, depends upon how well individual schools and one or both of the national printing teachers associations can influence young men and women to take up training for careers in the graphic arts.

Too much reliance is placed on such frayed and now trite expressions as the "art preservative of all arts," and the continued harping on Gutenberg and the "important" men who *once* were printers. This is a stale and well-worn bit of promotion that is no longer effective.

Young men and women want to know more about a career than these time-worn generalities. They want to know what the promotional opportunities are, how much money can be made in the graphic arts, how long it takes to "get there," and if they, with their individual talents, can find work that will make them happy. All of the arguments that printing educators can dream up will have little effect unless they give the facts for which youth is looking.

Our vocational printing courses are not faring so well these days. One would imagine that printing education in such a war-weary city as London, England, would be practically defunct. Not so. The enrollment has dropped from 3000 to "under 1000." This cut in enrollment is much less, after two years of war, than exists in the United States after but a few months of war. Some of our privately supported schools are ready to close their doors for lack of students. Other publicly supported printing schools and departments are down not 33 per cent as in England, but as much as 50 per cent and 75 per cent.

The apprenticeship system in the United States for the graphic arts is irrevocably a prize bust. The trades simply do not train apprentices. Graphic arts workers are becoming old men. Statistical data of one of the large unions for 1936 shows that 63 per cent were over 40 years of age, 26 per cent between 30 and 40, and only 11 per cent between 21 and 30. Furthermore, to show the breakdown of the apprenticeship system, it is pointed out that in 1910 there were 12 journeymen to each apprentice, in 1920, 14 journeymen to each learner, and in 1930, 20 seasoned workers to each apprentice. Now it is even worse.

Printing education needs a build-up. Guidance counselors, home-room teachers, and elementary and junior high school principals need to be sold on the graphic arts. They can be sold on the graphic arts if some campaign is made on a national as well as on a local scale. Most of them do not know of the opportunities which exist in this work, and for that reason they cannot pass the word along to the students in their charge.

In the past as now there has been too much misleading information spread about the graphic arts. The average educator is prone to class it along with all other types of vocational education. We still hear that

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those who have a tendency toward tuberculosis should not take up printing; that color blindness is a hindrance; that one must excel in English, and that artistic talent is prerequisite. This is nonsense.

Practically all abilities and all talents are useful in graphic arts work. A boy with a liking for mechanics who can't even spell "cat" can find his place in printing. Likewise one who makes excellent grades in grammar, but who shies away from things mechanical can find his niche. Few printers use any "artistic talent" — this is reserved for the layout man and the typographer. Color blindness has no effect on a make-up man. The tuberculosis idea is just plain silly, and a hangover from the time when all workers in *all* trades were more or less so diseased. Outside work, selling, is common in the graphic arts. All workers are not "cooped up."

The true scope, the real panorama of the graphic arts industry needs to be surveyed for the uninformed. Some of the facts can be pointed out as follows:

No other trade or profession contains so many varying talents and capabilities.

Statistics show that in the graphic arts, in comparison with comparable industries, the stability of employment is high; wages fluctuate relatively less and are high. The trend in wages is up, not down. Most printers make more than the vocational counselors who advise young men to take up other occupations.

Employment opportunities are higher than in comparable industries. Seasonal ups and downs in employment are less than in industries of like importance. It is a big business, having 60,000 establishments with an annual business volume of five billion dollars, 900,000 workers, and a pay roll of one billion dollars a year. Continued educational opportunities abound in universities, technical schools, and associations.

The graphic arts are necessary for national defense and war. It is common knowledge that the army and the navy are run on paper — paper that is printed or lithographed. Its newspapers and magazines help to keep up morale, its instructional handbooks are vital to the work of the Red Cross, the home guards, the workers in the defense factories. Its advertising sells the goods which pay the taxes to keep the forces armed and trained. The importance of the graphic arts should not be minimized as a factor in winning the war.

There are at least 30 occupations within the graphic arts which are sufficiently dissimilar to require special talents and training: bookbinder, camera operator, copyholder, cutter, cylinder pressman, estimator, foreman of camera, plate, composing, press and bindery departments, graphic arts teacher, hand compositor, layout man or typographer, layout man in lithography, light table man, linotype-intertype operator, machinist, Ludlow operator, make-up man, monotype caster and material maker operator, monotype keyboard operator, pamphlet binder, plant superintendent, platemaker, platen pressman, press feeder, pressman in lithography, proofreader, printing and lithography salesman, printing engineer, rotary pressman, stereotyper, stone or imposition man.

An analysis of the foregoing occupations within the graphic arts industry will show the variety of work done by the potpourri of workers employed. This information should be disseminated to all who advise students what careers to follow. There are, of course, some dirty-collar jobs in the graphic arts — but the great majority of workers are of the white-collar type. Wage scales of $60 per week are common.

It is hoped that promotion on the points brought out in this article, as well as other important facts, will be done by those really interested in graphic arts education — and that it be done soon, before it becomes another case of too little, and too late.

Testing and Tests

EVERY PUPIL SCHOLARSHIP TEST

ROBERT P. JENSEN

Teachers College
Emporia, Kans.

Industrial Arts — General Shop

General Directions: Read the directions for each part and follow them. Answer easy items first; return to others later. You will have exactly 40 minutes.

Part I

Directions: Read the following sentences carefully. If a statement is true, place a plus (+) in the parenthesis before the statement, as in example A below. If the statement is false, make a minus (—) in the parenthesis, as in example B.

Examples: (+) A. America was discovered by Columbus.
(—) B. The first president of the United States was Lincoln.

( ) 1. A draw knife can be used to rough shape outside curves.
( ) 2. The woodworking terms "chamfer" and "bevel" mean the same thing.
( ) 3. A screw driver should be ground to a sharp point to enter the screw easily.
( ) 4. Spindle turning is done on the faceplate of the lathe.
( ) 5. Number nine wire is smaller than number six wire.
( ) 6. The material used in making tin cans contains more iron than tin.
( ) 7. Solder is made of tin and lead.
( ) 8. The amount of carbon in high carbon steel is 2 per cent.
( ) 9. The U. S. S. thread is finer than the National Course thread.
( ) 10. Tinners' rivets are an alloy of tin and lead.
( ) 11. Mercury will not carry an electric current.
( ) 12. The flow of electricity is measured in volts.
( ) 13. The plates of a car storage battery are made of lead.
( ) 14. Curved lines in mechanical drawing are inked before straight lines.
( ) 15. An isometric drawing shows four plane views.
( ) 16. Dimension lines are as heavy as object lines.
( ) 17. Drawing boards should be made of a hard smooth wood such as maple.
( ) 18. In perspective drawings lines are parallel and do not converge toward a point.
( ) 19. The gouge in wood turning is used to rough turn stock.
( ) 20. The turning skew should be used to make finish cuts.
( ) 21. Sapwood of a log is harder than heartwood.
( ) 22. Shellac dries more rapidly than varnish.
( ) 23. Wood expands in wet weather.
( ) 24. No. 0 sandpaper is finer than No. 4/0 sandpaper.
( ) 25. Wood filler is wiped off along the direction of the grain.
( ) 26. Casein glue may be applied cold.
( ) 27. Hide glue should be heated to 200 deg. F.
( ) 28. Lumber is measured and sold by the square foot unit.
( ) 29. A ten point saw has ten teeth per inch.
( ) 30. Shellac is made from the secretion of a bug.
( ) 31. A spirit stain clouds the wood more than a water stain does.
( ) 32. A 6B lead in a drawing pencil is very soft.
( ) 33. If a one-eighth scale is used in drawing, a 20-in. line would be shown two and one half in. long.
( ) 34. There are 180 deg. in a circle.
( ) 35. A hexagon figure has eight sides.
( ) 36. The common fuse for the 110-volt light circuit is 15 amperes.
( ) 37. Connecting batteries in parallel does not increase the voltage.
( ) 38. A transformer works best on direct current.
( ) 39. In calculating electrical problems the volts are equal to the watts times the amperes.

( ) 40. When a coil of wire passes through a magnetic field, an electric current is caused to flow in the wire.
( ) 41. An alloy is a combination of two or more metals.
( ) 42. Galvanized iron is an example of an alloy.
( ) 43. Pig iron comes from the blast furnace.
( ) 44. The Bessemer process changes iron pigs to steel.
( ) 45. Bronze is an alloy of copper and zinc.
( ) 46. Iron oxide is the chemical name for rust.
( ) 47. Rosin is used as a flux in soldering galvanized iron.
( ) 48. Copper is a better conductor of heat than iron.
( ) 49. Aluminum is 2.7 times as heavy as water.
( ) 50. Iron is more than three times as heavy as aluminum.
( ) 51. Cutting tools are made of hardened machine steel.
( ) 52. The thickness of a tennon should be two thirds the thickness of the material.
( ) 53. The chief object of panel construction is to provide for shrinkage on a large surface.
( ) 54. Casein glue is a water resistant glue.
( ) 55. The best way to purchase animal glue is in the dry powdered form.
( ) 56. Hot water removes glue more easily than cold water does.
( ) 57. Wood filler should be allowed to stand one hour before it is removed.
( ) 58. The weight of the head in ounces determines the size of a hammer.
( ) 59. The size of a jointer is given in the length of the knife it uses.
( ) 60. Spindle speeds for shapers should not exceed 2000 r.p.m.
( ) 61. A hand saw is set to give clearance for the blade.
( ) 62. A dowel bit is like an auger bit but is shorter in length.
( ) 63. A piece of oak that has just been sawed has a sour odor.
( ) 64. Hard maple lumber comes from the Southern states.

Part II

Directions: Place the number of the part which makes the best answer to the statement in the parenthesis before the sentence, as in the example.

Example: (3) The capital of the United States is: (1) Boston; (2) Chicago; (3) Washington; (4) New York.

In this example "Washington" is the correct answer; therefore, a figure 3 has been placed in the parenthesis.

( ) 65. Dimension lines in mechanical drawing are as heavy as: (1) border lines; (2) object lines; (3) hidden lines; (4) extension lines; (5) no correct answer given.
( ) 66. Plane view working drawings are: (1) orthographic projections; (2) isometric drawings; (3) perspective drawings; (4) cabinet drawings; (5) no correct answer given.
( ) 67. The term that denotes the measure of electrical resistance is: (1) watt hour; (2) volt; (3) ohm; (4) ampere; (5) no correct answer given.
( ) 68. Of the following materials the best conductor of electricity is: (1) aluminum; (2) copper; (3) iron; (4) nichrome.
( ) 69. The unit by which electrical bills are computed is: (1) watt; (2) watt hour; (3) kilowatt hour; (4) kilowatt; (5) no correct answer given.
( ) 70. The protective device in an electric circuit which prevents fire in case of a short is a: (1) meter; (2) fuse; (3) damper; (4) armature; (5) insulator; (6) no correct answer given.
( ) 71. The shell of a dry cell battery is made of: (1) tin; (2) iron; (3) lead; (4) zinc; (5) aluminum; (6) no correct answer given.
( ) 72. If a motor takes 5 amps. at 110 volts it uses how many kilowatts of power? (1) 550; (2) 5500; (3) 55; (4) 5.5; (5) .55; (6) no correct answer given.
( ) 73. How many kilowatt hours of power will a fifty watt lamp use if burned for fifty hours? (1) 250; (2) 25; (3) 2.5; (4) .25; (5) no correct answer given.
( ) 74. What will it cost to burn a 100 watt lamp for 30 hours if the rate is eight cents per kilowatt hour? (1) 30c; (2) 24c; (3) 2.4c; (4) $2.40; (5) no correct answer given.
( ) 75. The circumference of a circle eight inches in diameter is: (1) 25.1328; (2) 24.26; (3) 16.2460; (4) no correct answer given.
( ) 76. Brass is an alloy of copper and: (1) tin; (2) zinc; (3) aluminum; (4) iron; (5) silver; (6) no correct answer given.
( ) 77. The tool used to start a hole for drilling in iron is the: (1) counter sink; (2) center punch; (3) drill punch; (4) drift punch; (5) no correct answer given.
( ) 78. Which twist drill is the smallest? (1) No. 60; (2) No. 40; (3) ¼ inch; (4) M; (5) Z; (6) no correct answer given.
( ) 79. What gauge of sheet metal is the heaviest? (1) 20; (2) 10; (3) 2/0; (4) 4/0.
( ) 80. The process of softening metals by heating is called: (1) tempering; (2) annealing; (3) pickling; (4) shrinking; (5) no correct answer given.
( ) 81. The size of an auger bit is given in: (1) fractions; (2) numbers meaning sixteenths; (3) decimals; (4) letters; (5) no correct answer given.
( ) 82. If lumber costs $75 per M board feet, it costs how much per foot? (1) 7.5c; (2) 75c; (3) .75c; (4) no correct answer given.
( ) 83. A board 1 inch by 4 inches by 12 feet contains how many board feet of lumber? (1) 12; (2) 3; (3) 4; (4) 6; (5) no correct answer given.
( ) 84. A board 2 inches by 2 inches by 36 inches contains how many board feet? (1) 1; (2) 2; (3) 3; (4) .5; (5) no correct answer given.
( ) 85. The softest one of the following woods is: (1) pine; (2) balsa; (3) oak; (4) basswood; (5) maple.
( ) 86. The hardest one of the following woods is: (1) maple; (2) hickory; (3) poplar; (4) willow; (5) walnut.
( ) 87. The most open-grained wood of the following group is: (1) mahogany; (2) birch; (3) cherry; (4) pine; (5) gumwood.
( ) 88. One should use wood filler on: (1) gumwood; (2) cherry; (3) oak; (4) pine; (5) birch.
( ) 89. Of the following group the best wood when exposed to weather is: (1) cypress; (2) maple; (3) elm; (4) gumwood; (5) pine.

Part III

Directions: From the list of answers in Column II select the word which matches each item of Column I, and write the number of the answer in the parenthesis at the left of the item. The items of one section may be matched only with the answers in Column II of the same section.

Column I	*Column II*
( ) 90. The number of degrees for the cutting angle of woodworking tools	1. FAS
( ) 91. The number of degrees in a triangle	2. f.h.b.
( ) 92. The number of degrees in a right angle	3. HB
( ) 93. The number of degrees in the cutting angle of a cold chisel	4. HCl
( ) 94. The number of hack-saw teeth per inch for cutting one-half inch iron	5. HNO_3
( ) 95. The number of rivets in one-half pound of the one-pound size of tinners' rivets	6. H_2O
( ) 96. The acid used to make cut acid flux	7. HO_2
( ) 97. The acid used to etch pewter	8. hp.
( ) 98. The voltage of a common car battery	9. H_2SO_4
( ) 99. The voltage of ten standard dry cells connected in series	10. S2S
( ) 100. The number of cycles per second for standard a.c. circuits	11. XB
( ) 101. The number of inches represented by the symbols (1'-7")	12. 6
( ) 102. The symbol for sulphuric acid	13. 7
( ) 103. Meaning two grades of hardwood lumber	14. 10
( ) 104. A type of wood screw	15. 15
( ) 105. A grade of hardness for the lead of a drawing pencil	16. 18
( ) 106. The unit of measure for mechanical power	17. 19
	18. 20
	19. 30
	20. 60
	21. 90
	22. 100
	23. 180
	24. 200
	25. 500
	26. 1000

( ) 107. A drawing tool used as a guide in drawing vertical lines	1. Alabama
( ) 108. The drawing tool used as a guide in drawing horizontal lines	2. ampere
( ) 109. The tool used to step off distances in drawing	3. anchor
	4. backsaw
	5. burnisher
	6. butt

( ) 110. The type of drawing where the horizon plays a part in the construction of lines
( ) 111. The tool used to drive a nailhead below the surface of the wood
( ) 112. The saw used to cut lengthwise of the grain
( ) 113. A saw used in cutting tenons
( ) 114. The type of joint used in picture-frame construction
( ) 115. The tool used to turn the edge of a cabinet scraper
( ) 116. A type of tack used in upholstering work
( ) 117. The name given to the hole through which the upper part of the screw is placed
( ) 118. The name given to the hole into which the threads of the woodscrew are turned
( ) 119. The reinforcing band around the end of a wooden handle
( ) 120. The bit used to bore holes larger than one inch
( ) 121. The tool used to widen the top of the hole in wood for flathead wood screws
( ) 122. The unit of measure for electrical power
( ) 123. The unit of measure for electrical pressure
( ) 124. The furnace used to reclaim scrap iron
( ) 125. The tool used to form a roundhead on a rivet
( ) 126. The tool used to cut outside threads
( ) 127. The tool used to cut inside threads
( ) 128. The state from which most of the iron ore comes
( ) 129. The state in which the largest iron mills are located
( ) 130. The state in which the largest automobile plants are located

7. coping saw
8. counter sink
9. die
10. dividers
11. expansion
12. ferrule
13. gimp
14. groove
15. Illinois
16. Michigan
17. Minnesota
18. miter
19. mortise
20. nail set
21. nut
22. Ohio
23. open hearth
24. Pennsylvania
25. perspective
26. pilot
27. rabbet
28. rasp
29. ripsaw
30. rivet set
31. shank hole
32. tap
33. tenon
34. T square
35. triangle
36. volt
37. watt
38. Wisconsin
39. try square

Key

Papers must be scored according to this key. Give one point for each correct answer. An omission is counted as an error. Possible score—130. No. wrong and omitted ——— = score ———.

Part I

1. +	12. —	23. +	34. —	45. —	56. +
2. —	13. +	24. —	35. —	46. +	57. —
3. —	14. +	25. —	36. +	47. —	58. +
4. —	15. —	26. +	37. +	48. +	59. +
5. +	16. —	27. —	38. —	49. +	60. —
6. +	17. —	28. —	39. —	50. —	61. +
7. +	18. —	29. —	40. +	51. —	62. +
8. —	19. +	30. +	41. +	52. —	63. +
9. —	20. +	31. +	42. —	53. +	64. —
10. —	21. —	32. +	43. +	54. +	
11. —	22. +	33. +	44. +	55. —	

Part II

65. 4	70. 2	75. 1	80. 2	85. 2
66. 1	71. 4	76. 2	81. 2	86. 1
67. 3	72. 5	77. 2	82. 1	87. 1
68. 2	73. 3	78. 1	83. 3	88. 3
69. 3	74. 2	79. 4	84. 1	89. 1

Part III

90. 19	99. 15	108. 34	117. 31	126. 9
91. 23	100. 20	109. 10	118. 26	172. 32
92. 21	101. 17	110. 25	119. 12	128. 17
93. 20	102. 9	111. 20	120. 11	129. 24
94. 16	103. 1	112. 29	121. 8	130. 16
95. 25	104. 2	113. 4	122. 37	
96. 4	105. 3	114. 18	123. 36	
97. 5	106. 8	115. 5	124. 23	
98. 12	107. 35	116. 13	125. 30	

Table showing percentile of the frequency distribution for this industrial-arts test:

Possible score	130	45%-ile	63
Highest score	117	40%-ile	61
99%-ile	96	35%-ile	59
95%-ile	89	30%-ile	58
90%-ile	83	25%-ile	56
85%-ile	79	20%-ile	54
80%-ile	77	15%-ile	51
75%-ile	74	10%-ile	48
70%-ile	72	5%-ile	44
65%-ile	70	1%-ile	37
60%-ile	69	Lowest score	22
55%-ile	67	No. of cases.....	1116
50%-ile	65		

Read table thus: The highest median score reported for any school for this test was 117. Ninety-nine per cent of the median scores did not exceed 96 (1 per cent reached or exceeded this score). Ninety-five per cent did not exceed 89 (5 per cent reached or exceeded this score), and so forth.

AUTO-MECHANICS TEST

MILTON SCHRAG

Instructor in Augusta Schools
Augusta, Kans.

Each trouble has more than one correct symtom or cause. Underline the letters preceding the statements which you believe cause the trouble described in the question.

Example: Carburetor noise is caused by (a) air-cleaner mounting loose; (b) vacuum passage obstructed; (c) loose deflector tube in intake manifold; (d) mixture too rich.

1. Lack of power, speed, and acceleration: (a) grade of fuel not suited to engine; (b) oil pressure too high; (c) worn valve guides; (d) valve clearance improperly adjusted.

2. Hard starting: (a) water or dirt in fuel; (b) weak valve springs; (c) fuel level in float chamber too low; (d) carburetor flooding.

3. Engine will not start: (a) distributor gear slipping; (b) high fuel level; (c) air leaks in vacuum spark control line; (d) coil burned out.

4. Bucking: (a) loose fan belt; (b) sticking valves; (c) excessive backlash; (d) broken starter spring.

5. Engine will not idle: (a) poor ignition; (b) spark-plug gaps too narrow; (c) poor ground at battery; (d) inoperative fuel pump.

6. Weak compression: (a) carburetor set too lean; (b) bearings too tight; (c) loose pistons; (d) valves not seating.

7. Cylinders scored: (a) lack of lubrication; (b) loose piston pin; (c) broken ring; (d) over lubrication.

8. Valves sticking: (a) valve spring broken; (b) valve adjusted too wide; (c) gum in fuel; (d) valve stem bent.

9. Smoky exhaust: (a) cracked valve seat; (b) oil pressure too high; (c) oil too thin; (d) mixture too rich.

10. High-speed vibration of engine: (a) unequal compression of cylinders; (b) misfiring; (c) unbalanced fan; (d) engine mounting loose.

11. Engine misfires at all speeds: (a) poor coil; (b) fouled plugs; (c) unbalanced flywheel; (d) valves holding open.

12. Engine misfires at high speed: (a) weak coil; (b) defective spark plugs; (c) carburetor too lean; (d) valves not properly timed.

13. Engine misfires at low idling speed: (a) poor oil; (b) cylinder head loose; (c) vacuum leak; (d) poor compression.

14. Vacuum gauge needle drops back at regular intervals: (a) valve stuck open; (b) warped valve seat; (c) burned valve; (d) late valve timing.

15. Vacuum gauge flickers worse with speed: (a) weak valve springs; (b) leaky cylinder-head gasket; (c) intake manifold leak; (d) loose valve guides.

16. Popping in muffler: (a) gasoline mixture too rich; (b) gasoline mixture too lean; (c) spark set late; (d) ignition trouble.

17. Oil pumping: (a) late valve timing; (b) worn piston rings; (c) worn valve guides; (d) ventilator or breather clogged.

18. Excessive oil dilution: (a) excessive choking; (b) unnecessary idling of engine; (c) defective oil gauge; (d) poor or erratic ignition.

19. Lose oil pressure: (a) oil too thin; (b) bearings in poor condition; (c) clearance between oil pump gear face and cover too large; (d) defective pressure-relief valve.

20. Engine will not start: (a) worn generator brush; (b) battery weak; (c) vacuum-spark advance not functioning; (d) rotor spring broken.

21. Breaker points arc and burn excessively: (a) defective condenser; (b) resistance unit out of circuit; (c) spark-plug gaps too wide; (d) weak breaker-arm spring.

22. Spark plugs badly burned: (a) worn bearings; (b) shorted condenser; (c) retarded spark; (d) lean mixture.

23. Unsteady ammeter reading: (a) generator belt slipping; (b) brush holder sticks; (c) poor connections in circuit; (d) too much voltage.

24. Generator dead: (a) low battery; (b) commutator dirty; (c) cutout points stuck open; (d) armature burned out.

25. Sparking at brushes: (a) poor brush contact; (b) brush setting wrong; (c) dirty commutator; (d) high mica on commutator.

26. Battery discharged: (a) starter spring broken; (b) short in wiring; (c) internal short circuit; (d) excessive charging rate.

27. New bulbs have insufficient candlepower: (a) poor connections; (b) weak battery; (c) dirty lens; (d) tarnished reflectors.

28. Lamps burn out: (a) charging rate too high; (b) poor or no ground at battery; (c) poor contacts in battery circuit; (d) battery charged too high.

29. Starter will not work: (a) armature grounded; (b) starting switch bad; (c) battery terminals loose or corroded; (d) clutch or bendix stuck or broken.

30. Flywheel starter teeth broken: (a)

spark advanced too far; (*b*) starter switch corroded; (*c*) brushes noisy; (*d*) armature shaft sprung.

31. Rapid brush wear: (*a*) weak field magnets; (*b*) excessive spring tension; (*c*) eccentric commutator.

32. Horn inoperative: (*a*) voltage too high; (*b*) blown fuse; (*c*) wire broken; (*d*) discharged battery.

33. Horn works intermittently: (*a*) poor contacts in horn button; (*b*) dirty commutator; (*c*) blown fuse; (*d*) dead battery.

34. Horn tone noisy: (*a*) voltage too high; (*b*) loose connections; (*c*) diaphragm cracked; (*d*) dirty commutator.

35. Radio does not operate: (*a*) poor spark-plug suppressors; (*b*) defective tubes; (*c*) bad vibrator; (*d*) blown fuse.

36. Radio weak: (*a*) weak batteries; (*b*) incorrect voltages; (*c*) open switch; (*d*) set not grounded.

37. Tubes do not light: (*a*) voltage too high; (*b*) set oscillates; (*c*) open fuse; (*d*) set not properly grounded.

38. Radio intermittent: (*a*) defective tubes; (*b*) broken antenna lead; (*c*) loose battery connections; (*d*) generator interference.

39. Brakes not holding: (*a*) glazed or hard lining; (*b*) misalignment of front spring; (*c*) too much self-energizing action; (*d*) high spots on lining.

40. Car pulls to one side when using brakes: (*a*) one lining adjusted too tight; (*b*) tires not properly inflated; (*c*) grease on linings; (*d*) rusted linkage.

41. Brakes fail to release: (*a*) frozen bearings in brake linkage; (*b*) poor tires; (*c*) weak retractor springs; (*d*) lining worn too thin.

42. Lining wears rapidly: (*a*) grease on linings; (*b*) glazed lining; (*c*) brakes dragging; (*d*) rough drums.

43. Brakes squeal: (*a*) high spots on lining surface; (*b*) loose rivets; (*c*) fluid low; (*d*) too much toe board pedal clearance.

44. Hydraulic brakes drag (all): (*a*) leak in system; (*b*) air in system; (*c*) piston cups swollen through use of mineral oil; (*d*) dirt in master-cylinder compensating port hole.

45. One hydraulic brake drags: (*a*) air in line; (*b*) weak return spring; (*c*) loose wheel bearing; (*d*) shoes set too close to drum.

46. Hydraulic brakes springy pedal: (*a*) air in systems; (*b*) shoes not properly adjusted; (*c*) worn linings; (*d*) scored drums.

47. Clutch slips: (*a*) hard or dry facings; (*b*) grease on facings; (*c*) too little free pedal travel; (*d*) worn facings.

48. Clutch chatters: (*a*) clutch release spring unfastened; (*b*) grease on facings; (*c*) facings worn or glazed; (*d*) clutch shaft bent.

49. Springs break (wheel): (*a*) overloading; (*b*) loose U bolts; (*c*) loose flywheel pan; (*d*) use of too much oil.

50. Excessive wear on front tires: (*a*) tires inflated too high; (*b*) faulty wheel alignment; (*c*) under inflated; (*d*) reckless brake application.

51. Cupping of front tires: (*a*) low tire pressure; (*b*) incorrect wheel toe-in; (*c*) incorrect camber; (*d*) too much or too little caster.

52. Body doors bind: (*a*) sprung hinges; (*b*) body holddown bolts loose; (*c*) lack of lubrication; (*d*) too much oil used.

Key

1. *a, c*	5. *a, b, c*	9. *b, c, d*
2. *a, b, c, d*	6. *c, d*	10. *a, b, c, d*
3. *a, d*	7. *a, b, c*	11. *a, b, d*
4. *b, c*	8. *a, c, d*	12. *a, b, c, d*
13. *b, c, d*	27. *a, b, c, d*	41. *a, c*
14. *a, b, c*	28. *a, b, c*	42. *c, d*
15. *a, d*	29. *a, b, c, d*	43. *a, b*
16. *a, b, d*	30. *a, d*	44. *c, d*
17. *b, c, d*	31. *b, c*	45. *b, c, d*
18. *a, b, d*	32. *b, c, d*	46. *a, b*
19. *a, b, c, d*	33. *a, b*	47. *b, c, d*
20. *b, d*	34. *b, c, d*	48. *b, c, d*
21. *a, b, c, d*	35. *b, c, d*	49. *a, b*
22. *c, d*	36. *a, b*	50. *b, c, d*
23. *a, b, c*	37. *c, d*	51. *a, b, c, d*
24. *b, c, d*	38. *b, c*	52. *a, b, c*
25. *a, b, c, d*	39. *a, d*	
26. *b, c*	40. *a, b, c, d*	

OXYACETYLENE WELDING TEST

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Instructions

1. This test contains 50 true-false statements.

2. Read each statement carefully.

3. If you think that the statement is true, put an X in the parentheses placed to the left of the statement.

4. If you think the statement is false, put a zero (0) in the parentheses.

5. Study the samples carefully before beginning actual work.

Samples

(X) 1. Most common commercial metals can be welded.

(O) 2. Copper is an alloy.

Test Statements

( ) 1. The working pressure on the hose is shown by the high pressure gauge.

( ) 2. The combustion of the gases takes place at the welding tip.

( ) 3. The two gases are brought together in the mixing chamber.

( ) 4. The improper mixture of gases causes flash backs.

( ) 5. The regulator diaphragms are in motion whenever gas is being used.

( ) 6. Oxygen regulators are more sensitive than acetylene regulators.

( ) 7. Acetylene regulators can be interchanged with oxygen regulators.

( ) 8. Copper is used in the manufacture of the diaphragms for acetylene regulators.

( ) 9. Creeping regulators may be caused by a cracked or grooved seat.

( ) 10. Fourteen and one-half cubic feet of acetylene weigh one pound.

( ) 11. Acetone is used as an absorbent in acetylene cylinders.

( ) 12. Cotton is used as an absorbent when charging oxygen cylinders.

( ) 13. Oxygen is an odorless, tasteless, and colorless gas.

( ) 14. Oxygen cylinders have welded seams.

( ) 15. The standard oxygen cylinders, when fully charged, contain 200 cubic feet of gas.

( ) 16. Oxygen cylinders are equipped with double seating valves.

( ) 17. Oxygen is rich in carbon content.

( ) 18. Acetone will absorb twenty-five times its own volume of acetylene gas at normal pressure.

( ) 19. Changes in temperature do not affect the pressure of acetylene when the cylinders are fully charged.

( ) 20. The valves on both cylinders should be opened wide when turning on the gas.

( ) 21. A neutral flame is composed of about equal parts of oxygen and acetylene.

( ) 22. The temperature of the flame varies with the different sized tips.

( ) 23. A number one tip is larger than a number three tip.

( ) 24. Too much acetylene causes a weld to become brittle.

( ) 25. White foam rises on the surface of steel when too much oxygen is used.

( ) 26. Empty acetylene cylinders should be kept closed.

( ) 27. Regulators should be well oiled to make them work more easily.

( ) 28. Welders govern their speed by the advance of the puddle.

( ) 29. Piston rings make good filler rods.

( ) 30. Flux is best applied by sprinkling it on the weld by hand.

( ) 31. Blow holes and hard spots are usually caused by lack of heat.

( ) 32. The metal should be in a molten condition before the filler rod is applied.

( ) 33. The temperature of oxyacetylene gas is estimated to be about 5800 deg. F.

( ) 34. It is practically impossible to cut through more than 12 in. of solid steel with an oxyacetylene cutting torch.

( ) 35. A carbonizing flame has a ratio of one part of acetylene to one and one tenth (1.1) parts of oxygen.

( ) 36. A common method of avoiding heat strains is to preheat the metal evenly before welding.

( ) 37. Thick pieces of metal will warp or buckle more readily than thin pieces.

( ) 38. Internal stresses can be relieved by reheating and allowing the metal to cool slowly and evenly after the weld is made.

( ) 39. Flux is not used on cast-iron welds.

( ) 40. The higher the carbon content of steel the easier it is to produce a satisfactory weld.

( ) 41. There is only one form of cast iron.

( ) 42. The welding rod should be of the same chemical composition as the base metal.

( ) 43. The inner tip or cone should be brought in contact with the metal which is being welded.

( ) 44. An excess of acetylene in the flame causes a weld to become porous and brittle.

( ) 45. The nut on the acetylene hose connection has a right-hand thread.

( ) 46. Flux acts as a deoxidizer.

( ) 47. Fluxes should be kept in closed containers when not in use.

( ) 48. The expansion and contraction of steel is greater than that of nonferrous metals and alloys.

( ) 49. Malleable iron castings are weldable with steel rods.

( ) 50. Preheating is necessary when cutting metal with the oxyacetylene torch.

KEY

1. O	11. X	21. X	31. X	41. O
2. X	12. O	22. O	32. X	42. X
3. X	13. X	23. O	33. X	43. O
4. X	14. O	24. X	34. O	44. X
5. X	15. X	25. X	35. O	45. O
6. O	16. X	26. X	36. X	46. X
7. O	17. O	27. O	37. O	47. X
8. O	18. X	28. X	38. X	48. O
9. X	19. O	29. O	39. O	49. O
10. X	20. O	30. O	40. O	50. X

COMPREHENSIVE WOODWORKING TEST

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Thirty-one college students who have completed one quarter of work in Elementary Woodwork took this comprehensive woodworking test at the end of the quarter. The median score made by the class is 121 with an upper quartile score of 135 and a lower quartile score of 86.

A comparison of the grades in the academic subjects revealed that students who were in the lower quartile were on the average poor academic students while students who were in the upper quartile were on the average better academic students.

Comprehensive Woodworking Test True-False Statements

Examine each statement below and decide whether it is *true* or *false*. Draw a circle around the correct answer. *Do not guess.* This test will be scored by subtracting the wrong answers from the number of correct answers.

T. F. 1. Tensile strength is the opposite to crushing strength.
T. F. 2. As a rule softwoods are lighter than hardwoods.
T. F. 3. Sapwood is generally more resistant to decay than heartwood and frequently less absorbent.
T. F. 4. Summer wood is stronger than spring wood.
T. F. 5. Sapwood is heavier than spring wood.
T. F. 6. Toughness of wood is its resistance to a change of shape and varies with the cube of its depth.
T. F. 7. Stiffness of wood is the ability to change shape without breaking.
T. F. 8. In general, hardwoods shrink less than softwoods.
T. F. 9. When grading wood, density, strength, and weight are included.
T. F. 10. Plywood is built up of three, five, or seven sheets of veneer glued together with the grain of adjacent layers running at right angles.
T. F. 11. Sometimes medullary rays are cut slightly on the diagonal and when such boards are placed side by side an interesting "herringbone" figure results.
T. F. 12. The grain of fir shows to best advantage in radially cut lumber, that is, quarter-sawed boards.
T. F. 13. Bird's-eye maple is a particular branch of the maple family.
T. F. 14. The law of right angles is convenient for squaring large surfaces such as table tops which are square or rectangular.
T. F. 15. Boards 8 to 12 in. inclusive shall be not more than 5/8 in. less than the nominal width according to the manufacturing classification.
T. F. 16. The standard yard board and the standard industrial board are of the same thickness for rough dry sizes.
T. F. 17. White oak is a close-grain wood and it does not require a paste wood filler.
T. F. 18. The tang type of chisel is used in wood turning.
T. F. 19. Plane irons are ground to an angle of 25 to 30 deg.
T. F. 20. Quarter-sawed lumber warps less than plain-sawed lumber.
T. F. 21. Shellac brushes are kept in turpentine.
T. F. 22. An 8d flooring brad is heavier than an 8d casing nail.
T. F. 23. The head of a wire nail is the same as that of a brad.
T. F. 24. The bell-face hammer is less likely to let the edge strike the surface and leave a mark than is the plain-faced hammer.
T. F. 25. When driving nails, beginners should "choke" the hammer by grasping it near the head.
T. F. 26. The skew chisel is used in turning short convex curves.
T. F. 27. In turning flat surfaces, such as bread platters, trays, and lamp bases, the wood is cut roughly with the saw near the exact size and then it is screwed on the faceplate.
T. F. 28. A shooting board and plane are used for fitting miter joints more accurately.
T. F. 29. When pushing a hand scraper, the thumbs should be on the same side.
T. F. 30. A hand scraper should have a smaller edge or burr for scraping hardwood than when scraping softwoods.
T. F. 31. A ten-point saw cuts smoother than an eight-point saw.
T. F. 32. The jointer plane is used for smoothing small surfaces.
T. F. 33. A panel gauge is smaller than a marking gauge.
T. F. 34. The frog of the jack, smooth, and jointer plane may be moved back and forth to allow for various widths of the throat opening.
T. F. 35. In cheap furniture construction, chestnut is used to imitate oak.
T. F. 36. The steel square is used in place of the try square when squaring table tops and is used in the same manner as the try square.
T. F. 37. It is better to use a sharp pencil than a knife for accurate measurements.
T. F. 38. It is better to cut trees for lumber in the summer than in the winter.
T. F. 39. The quality of work depends very largely upon the quality and condition of the tools.
T. F. 40. The starting cut with the ripsaw should be made on the forward stroke.
T. F. 41. It is a common practice to plane over a surface that has been sandpapered.
T. F. 42. The plane iron cap of a smooth plane is fastened on the flat side of the blade to act as a chip breaker.
T. F. 43. The jointer plane is used to true up large surfaces and edges after the jack plane has roughly smoothed them.
T. F. 44. The jointer plane and the fore plane are the same.
T. F. 45. The pin of the marking gauge should project about 1/16 of an inch.
T. F. 46. A well-made joint of basswood material, properly glued, is stronger than any other part of the board.
T. F. 47. Hot glue is prepared by heating "chip glue" which has been soaked in water for a sufficient length of time — 12 to 24 hours.
T. F. 48. The joints that are commonly used in widening boards are: tongue and groove, rabbeted or ship-lap, beaded tongue and groove, spline or slip tongue.
T. F. 49. A firmer tang chisel is used where pounding with a mallet is necessary.
T. F. 50. Rabbeting is the term used by woodworkers to denote the recessing of the edge of stock.
T. F. 51. The rabbet plane is used to cut out stair stringers to receive the treads and risers.
T. F. 52. The cutters of the spokeshave are sharpened in the same way as plane irons.
T. F. 53. Chamfers, up to one and one half inches, can be cut out uniformly with a special spokeshave.
T. F. 54. Chisels are sharpened just like plane irons.
T. F. 55. It is harder to sharpen the teeth on the crosscut saw than on the ripsaw.
T. F. 56. Except for very fine work, a saw is set about twice the thickness of the blade.
T. F. 57. The crosscut saw and the ripsaw are not jointed and set in the same way.
T. F. 58. The backsaw is sharpened like a crosscut, except that the teeth are beveled about 60 deg. and the file is dipped about 10 deg.
T. F. 59. After the saw has been filed the burrs on the sides of the teeth are removed by passing the file lightly along the side of the saw.
T. F. 60. Coping-saw blades are sharpened with a slim tapered file.
T. F. 61. A dovetail saw is practically the same as a crosscut saw except that it is somewhat smaller.
T. F. 62. The more often glue is heated the stronger it gets.
T. F. 63. Chisels that are to be pounded with a mallet should have a larger bevel than the paring chisels.
T. F. 64. Auger bit guiders are made of brass disks that have a soft metal center into which the spur of the auger can be turned without injuring the thread on the spur.
T. F. 65. The twist bit does the cutting with the side and the gimlet does the cutting with the end.
T. F. 66. It is best to bore a hole entirely through from one side with an auger bit.

Multiple-Choice Response

Each of the following statements can be answered correctly by one and only one numbered expression. Write the number which

stands for the correct answer in the parentheses at the left of the statement.

( ) 1. The plane iron of a smooth plane rests directly on (1) a cap screw; (2) a frog; (3) a lever; (4) a spring; (5) an adjusting nut.

( ) 2. The plane iron cap can be removed by first releasing the (1) cap iron; (2) adjusting nut; (3) lateral adjusting lever; (4) cam lever; (5) Y adjusting nut.

( ) 3. The best all-round plane is the (1) smooth plane; (2) block plane; (3) universal plane; (4) jack plane; (5) circular plane.

( ) 4. When boring holes on repair work where there is a chance of striking nails or screws one should use (1) twist bit; (2) a gimlet bit; (3) a twist drill; (4) an auger bit; (5) a forstner bit.

( ) 5. A smooth hole can be bored through a knot with (1) a twist bit; (2) a gimlet bit; (3) a twist drill; (4) an auger bit; (5) a forstner bit.

( ) 6. The sizes of auger bits are indicated on the shank in (1) eighths; (2) sixteenths; (3) twenty-fourths; (4) thirty-seconds; (5) sixty-fourths.

( ) 7. Gimlet bits are graded in sizes from (1) ¼ to ¾ in.; (2) ⅛ to 1 in.; (3) 1/16 to ⅜ in.; (4) ⅛ to ½ in.; (5) 1/16 to 1 in.

( ) 8. The length of an 8d common nail is (1) ½ in.; (2) 1½ in.; (3) 2 in.; (4) 2½ in.; (5) 3 in.

( ) 9. One fourth inch screws may be obtained in gauges (1) 0–2; (2) 0–3; (3) 0–4; (4) 0–5; (5) 0–6.

( ) 10. The most common scraper is known as the (1) French scraper; (2) cabinet scraper; (3) hand scraper; (4) glue scraper; (5) bench scraper.

( ) 11. The edge of the scraper is turned with (1) a file; (2) skew chisel; (3) paring chisel; (4) round-nose chisel; (5) burnisher.

( ) 12. In wood turning the tool used for cutting off the stock is (1) skew chisel; (2) gouge; (3) roundnose chisel; (4) parting tool; (5) diamond-point tool.

( ) 13. The first tool used when turning between centers is the (1) skew chisel; (2) roundnose chisel; (3) gouge; (4) parting tool; (5) diamond-point chisel.

( ) 14. What stain raises the grain of the wood most: (1) oil stain; (2) acid stain; (3) spirit stain; (4) water stain; (5) varnish stain?

( ) 15. In putting bottoms in drawers, a small quantity of glue should be applied to the groove on (1) all four sides; (2) the front and the back; (3) two sides; (4) the front; (5) the back.

( ) 16. The bottoms of large drawers are strengthened with the use of (1) a mullet; (2) drawer slip; (3) drawer slide; (4) a muntin; (5) drawer guider.

( ) 17. A shellac brush should be cleaned in (1) gasoline; (2) turpentine; (3) kerosine; (4) benzine; (5) alcohol.

( ) 18. The nail that is commonly set below the surface is a (1) common nail; (2) floor nail; (3) box nail; (4) finishing nail; (5) wire nail.

( ) 19. The easiest stain to apply is the (1) water stain; (2) oil stain; (3) acid stain; (4) spirit stain; (5) varnish stain.

( ) 20. Screws are commonly sold by the (1) pound; (2) hundred; (3) dozen; (4) keg; (5) gross.

( ) 21. A tool used for boring various sized holes is called (1) forstner bit; (2) expansive bit; (3) gimlet bit; (4) twist bit; (5) auger bit.

( ) 22. The gauge that is used for locating lines for door hinges is the (1) mortise gauge; (2) marking gauge; (3) finger gauge; (4) butt gauge; (5) pencil gauge.

( ) 23. Which one of the following woods is a softwood, according to the wood turners' classifications: (1) rosewood; (2) ebony; (3) tulip; (4) kingwood; (5) walnut?

( ) 24. Which one of the woods is the hardest according to the wood turners' classifications: (1) mahogany; (2) beech; (3) ash; (4) oak; (5) lignum vitae?

Completion

Read the following statements and fill in the missing word or words to complete the meaning of the sentence. One point will be given for the blank or blanks correctly filled in.

1. The weight of a piece of wood depends upon the ..... of its structure and the amount of ..... in it.
2. There is a test for hardness of woods which measures the hardness in terms of the weight required to sink a punch 1 cm. in area to a depth of ..... of an inch perpendicular to the fiber of the wood.
3. Trees growing with the pores arranged definitely in rings are said to be .....
4. In certain trees where the pores are of nearly equal size and are scattered throughout the wood, the division between large pores and small pores is not noticeable; this type is known as being ....
5. The formation of a thin layer of cells which run from the heartwood to the outer surface are known as ....
6. The strength of a timber is indicated in three ways: (1) ....., (2) ....., and (3) .....
7. The bending or cross breaking strength of wood varies ..... with the length of the wood and ..... with the square of the depth.
8. Lumber in which the outer part has been dried too rapidly is known as .... lumber.
9. In grading hardwood lumber first calls for pieces containing ..... feet free from defects or ..... feet with no more than two defects.
10. Rules for grading hardwood lumber in the United States have been adopted by the ..... Hardware Lumber Association.
11. Seconds may have one defect to ..... surface feet and up to five defects in ..... surface feet.
12. Logs that are cut parallel to the rays across the annual rings produce ..... sawed lumber.
13. Logs that are cut at right angles to the medullary rays produce ..... sawed lumber.
14. ..... is the process of laying a thin sheet of expensive wood on foundation or base of common woods.
15. The three ways into which veneer may be cut from a log are (1) ....., (2) ....., and (3) .....
16. When logs are cut so that the sides of the medullary rays are visible, the flakes or figures resulting are called ..... grain.
17. ..... is the name given to a short broken stripe found principally in mahogany.
18. ..... consist of fine, regular waves in the grain of maple wood.
19. When the waves in the fibers occur singly or in groups with large spaces between, the figure is called .....
20. Lumber is classified as yard lumber, which is less than ..... in thickness and is intended for general building purposes, ... lumber, which is intended for use in further manufacturing; and structural timbers, which are ..... or over in thickness and width.
21. Manufactured lumber is classified as ....., which is undressed lumber as it comes from the saw; ..... which is dressed by running it through a planer; and ..... which is lumber that has been run through a matching machine, sticker, or molder.
22. The abbreviation ..... means surfaced on one side; ..... means surfaced on two sides; ..... means surfaced on one edge; ..... means surfaced on four sides; and ..... means surfaced on two sides and one edge.
23. The measuring system used by woodworkers in this country is the ..... system, known as feet, inches, and fraction of an inch.
24. There are several kinds of planes, but the first plane we use is called a ..... plane.
25. To test a board to see if it is out of wind, one may use ..... sticks.
26. The simplest and most common joint for gluing is known as the ..... or square joint.
27. Joints commonly used in widening boards are (1) ....., (2) ....., (3) ....., and (4) .....
28. A firmer ..... chisel is used where hand pressure or light tapping is sufficient.
29. A ..... chisel is used where pounding with a mallet is necessary.
30. ..... is the term used to denote the recessing or the edge of any piece or article.
31. A ..... stone is necessary to sharpen a gouge.
32. Except for very fine work a saw is set about ..... the thickness of the blade.
33. The two ways of sharpening a saw are by filing toward the ..... and toward the .....
34. The proper procedure in sharpening a crosscut saw is (1) ....., (2) ....., (3) ....., and (4) .....
35. Spokeshave knives are ground like ....
36. The tool used for making conical depressions for the heads of flathead wood screws is called .....
37. Round pieces of wood used to assist in joining boards which are glued to edges are called .....
38. A tool used for making lines parallel to a surface is a ....
39. A ..... joint is made when two pieces are cut at 45 deg. as for a picture frame.

40. A tool used for cutting of holes from ⅞ to 3 in. in diameter is called an ....
41. Dimensions for lumber are given in the following order: (1) ....., (2) ....., and (3) .....
42. Put ..... on screws to make them go into wood more easily.
43. The blade is ground on the upper side in a ....
44. The three distinct types of twists in auger bits are known as (1) ...., (2) ...., and (3) ....
45. ..... bits are used for enlarging holes that have been bored too small.
46. The lead hole drilled for the screw should be ..... per cent of the core diameter, in softwoods, and ..... per cent in hardwoods to develop the maximum strength.
47. Two kinds of claw hammers are ..... and .....
48. The three steps involved in the sharpening of a scraper are (1) ....., (2) ....., and (3) .....
49. The grades of sandpaper for general use vary from No. ..... to No. .....
50. The three methods of fastening table tops to rails are (1) ....., (2) ....., and (3) .....
51. ..... add to the life of a drawer because they reinforce the sides where the most wear takes place.
52. Another method of strengthening a drawer bottom is by the use of a ..... and it is advisable to use one in drawers over 24 in. in length.
53. A ..... is used to try the bottom of a drawer for correct thickness.
54. The first tool used in turning is known as a .....
55. The parting or cut-off tool is used for two purposes, ... and .....
56. The three kinds of stains are (1) ....., (2) ....., and (3) .....
57. The six kinds of finishes are (1) ....., (2) ....., (3) ....., (4) ....., (5) ....., and (6) .....
58. Paste wood ..... is used on open-grain wood.
59. To get a polished finish the last coat should be rubbed first with pulverized ..... stone and water and then rubbed with ..... stone and water.
60. For a ..... finish the last coat is not rubbed at all.

Definitions

Define each in one sentence. One point will be given for each correct definition.

1. Arris .....
2. Flute .....
3. Stop chamfer .....
4. Gimp .....
5. Webbing .....
6. Counterboring .....
7. Skew chisel .....
8. Crosscut saw.....
9. Screw gauges.....
10. Butt joint .....

Define by Drawing

Make a sketch drawing to illustrate each. One point will be given for each correct illustration.

1. Arris
2. Flute
3. Stop chamfer
4. Counterboring
5. Ripsaw teeth
6. Crosscut teeth
7. Butt joint
8. Flathead screw
9. Box nail barbed
10. Flooring brads
11. Dowel
12. French scraper

Matching

Place a corresponding number in each blank to indicate degree of hardness of each tree.

Table of Hardness of Woods

1. Hardest	A.....Elm
2. Very hard	B.....Douglas Spruce
3. Hard	C.....Pine
4. Medium	D.....Cotton tree of India
5. Soft	E.....Lignum-vitae
6. Very soft	F.....Beech

Classification of Woods

Place a one in the blank space if the wood is diffused porous or a two if it is ring porous.

.....Ash, ...Oak, ...Beech, ...Chestnut, ...Birch

Problems

Problems 1 and 2 are six points each and problem 3, eight points.

1. If the specific gravity of oak is .65 what is the weight of oak which has the following dimensions: 1″ x 9″ x 16′-0″. Weight of water is 62.4 lb. per cubic foot.
2. Make a sample lumber order of the following: 10 pieces of yellow pine 1 in. thick, 16 ft. long, 8 in. wide, kiln dried, common and rough. Six pieces white pine, 6 in. in width, 10 ft. long, ⅝ in. in thickness, clear, surfaced four sides. Twenty-four pieces of quarter-sawed lumber, 2 in. thick, 12 ft. long, 9 in. wide, surfaced one edge and one side, kiln dried, black walnut.
3. Find the cost of the following pieces of lumber:
   a) 4 pcs. ⅜″ x 6″ x 16′-0″ @ $125 per M.....ans. .....
   b) 2 pcs. 1½″ x 8″ x 9′-0″ @ $55 per M.....ans. .....
   c) 1 pc. 2½″ x 10″ x 12′-0″ @ $95 per M.....ans. .....
   d) 50 lin. ft. 2″ x 2″ @ $.15 per lin. ft.....ans. .....

Key for Comprehensive Woodworking Test

Key for True-False Statements

1. T	12. F	23. F	34. T	45. T	56. F
2. T	13. F	24. T	35. T	46. T	57. F
3. F	14. T	25. F	36. T	47. T	58. T
4. T	15. T	26. F	37. F	48. T	59. F
5. F	16. F	27. T	38. F	49. F	60. F
6. F	17. F	28. T	39. T	50. T	61. F
7. F	18. T	29. T	40. F	51. F	62. F
8. F	19. T	30. T	41. F	52. T	63. F
9. F	20. T	31. T	42. T	53. T	64. T
10. T	21. F	32. F	43. T	54. T	65. F
11. T	22. T	33. F	44. T	55. T	66. F

Key for Multiple-Choice Response

1. (2)	5. (5)	9. (1)	13. (3)	17. (5)	21. (2)	
2. (5)	6. (2)	10. (3)	14. (4)	18. (4)	22. (4)	
3. (4)	7. (3)	11. (5)	15. (4)	19. (2)	23. (5)	
4. (3)	8. (4)	12. (4)	16. (4)	20. (5)	24. (5)	

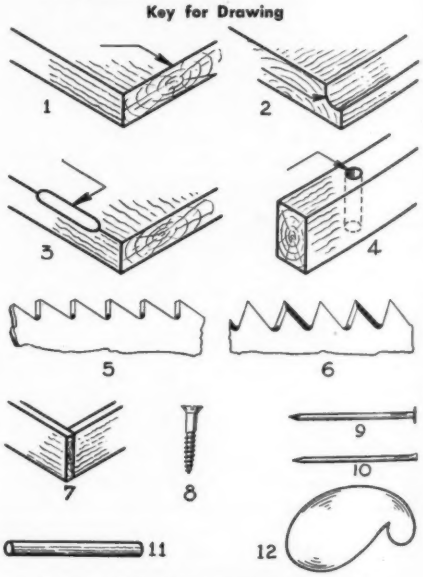
Key for Completion

1. Compactness — moisture
2. 1/20th. or 1.27mm.
3. Ring porous
4. Diffused porous
5. Medullary rays or pith rays
6. Crushing, bending, shearing
7. Inversely, directly
8. Case hardened
9. Nine and sixteen
10. National
11. Five, twenty
12. Quarter
13. Plain
14. Veneering
15. Sawn, knife cut, rotary cut
16. Silver
17. Roe
18. Fiddleback
19. Raindrops
20. Five inches, factory, five in.
21. Rough, surfaced, worked
22. S1S, S2S, S1E, S4S, S2S1E
23. English
24. Jack
25. Winding
26. Rubbed or butt
27. Tongue and groove, rabbet or shiplap, spline or slip tongue, beaded tongue and groove or square
28. Tang
29. Socket
30. Rabbeting
31. Slip
32. Half
33. Point, handle
34. Jointing, setting, sharpening, honing
35. Plane irons
36. Countersink
37. Dowels
38. Marking gauge
39. Miter
40. Expansive bit
41. Thickness, width, length
42. Soap or wax
43. Block plane
44. Single twist, double twist, straight core
45. Reamer
46. Seventy, ninety
47. Flat or bell faced, plain faced
48. Filing, honing, burnishing
49. 10/0, 4
50. Counter bored screw, metal fastener, angle irons
51. Slips
52. Muntin
53. Mullet
54. Gouge
55. Cut off stock, determine proper diameter
56. Water, oil and acid or spirit
57. Paint, oil, wax, shellac, varnish, lacquer
58. Filler
59. FF pumice, rotten
60. Gloss

Key for Definitions

1. An arris is the intersection of two surfaces
2. If a chamfered surface is made concave, it is called a "flute"
3. When only part of an arris is removed it is called a stop chamfer
4. Gimp is a narrow edging used for covering raw edges of the cover and heads of the common tacks which secure the cover in upholstering
5. Webbing is a narrow band, varying from 3 to 4 in. in width, made of jute fiber used in upholstering to hold springs in place.
6. Counterboring is boring a hole part ways into a rail
7. Skew chisel is a tool used in wood turning
8. A crosscut saw is used for cutting across the grain of the wood
9. Screw gauges are used to determine the diameter of screws
10. The butt joint is used in the construction of anything that has the sides jointed at right angles, such as boxes.

Key for Drawing



Comprehensive woodworking test

Key for Matching

A. (2) B. (4) C. (5) D. (6) E. (1) F. (3)

Key for Classification of Woods

Must be in the following order: (2), (2), (1), (2), (1)

Key for Problems

1. 40.56 lb.
2. 10 pcs. 1″ x 8″ x 16′-0″ Y.P. K.D. com. rough
   6 pcs. ⅝″ x 6″ x 10′-0″ W.P. Clr. S4S
   24 pcs. 2″ x 9″ x 12′-0″ BI.W. Qtd. S1S1E
3. (*a*) $4, (*b*) $.99, (*c*) $2.38, (*d*) $7.50

Problems and Projects

GLIDER WITH SUCTION-CUP TIP

TERENCE VINCENT

Hobby Shop
Ypsilanti, Mich.

Gliders with suction-cup tips are developed through many test flights. One does not just put the suction cup on the end of an ordinary glider, and at once achieve success. Several thousands of flights, with hundreds of breakages and consequent rebuildings finally revealed the structure shown herewith.

This glider, with a suction cup for its nose, is shot overhead fashion, with wings level and nose pointed at the target or wall. When released at the tail end (not tossed from the front), this glider goes as straight as an arrow, and sticks momentarily to the wall, mirror, blackboard, or other smooth vertical surface.

In our hobby shop, we have game designs on the side walls, and a large linoleum map of the United States on the floor. Suction-cup-nosed gliders are frequently used for playing these games.

Construction

Step 1. Cut a slot 1/16 by 1½ in. in one end of body stick. Cut tail to size and cement it in place. See Figures 1 and 3.

Step 2. Cement suction cup to one end of the bamboo. Stick a pin through it and tie thread around bamboo ends, including pin and suction cup. Cover thread with cement. See Figures 2 and 3.

Step 3. Figure 3 shows the body completed, with hole under bamboo through which the No. 33 rubber band must be passed. This rubber band provides the catapulting power.

Step 4. Cut out the balsa wing, 1/16 by 2 by 8 to 15 in., and the balsa elevator, 1/16 by 1 by 6 to 12 in., as shown in Figure 4.

Step 5. Arrange the wing and the elevator as shown in Figure 5.

The airplane cement, nitrocellulose, used for fastening the parts together, is quite resilient and will stand up well when the glider strikes against any surface.

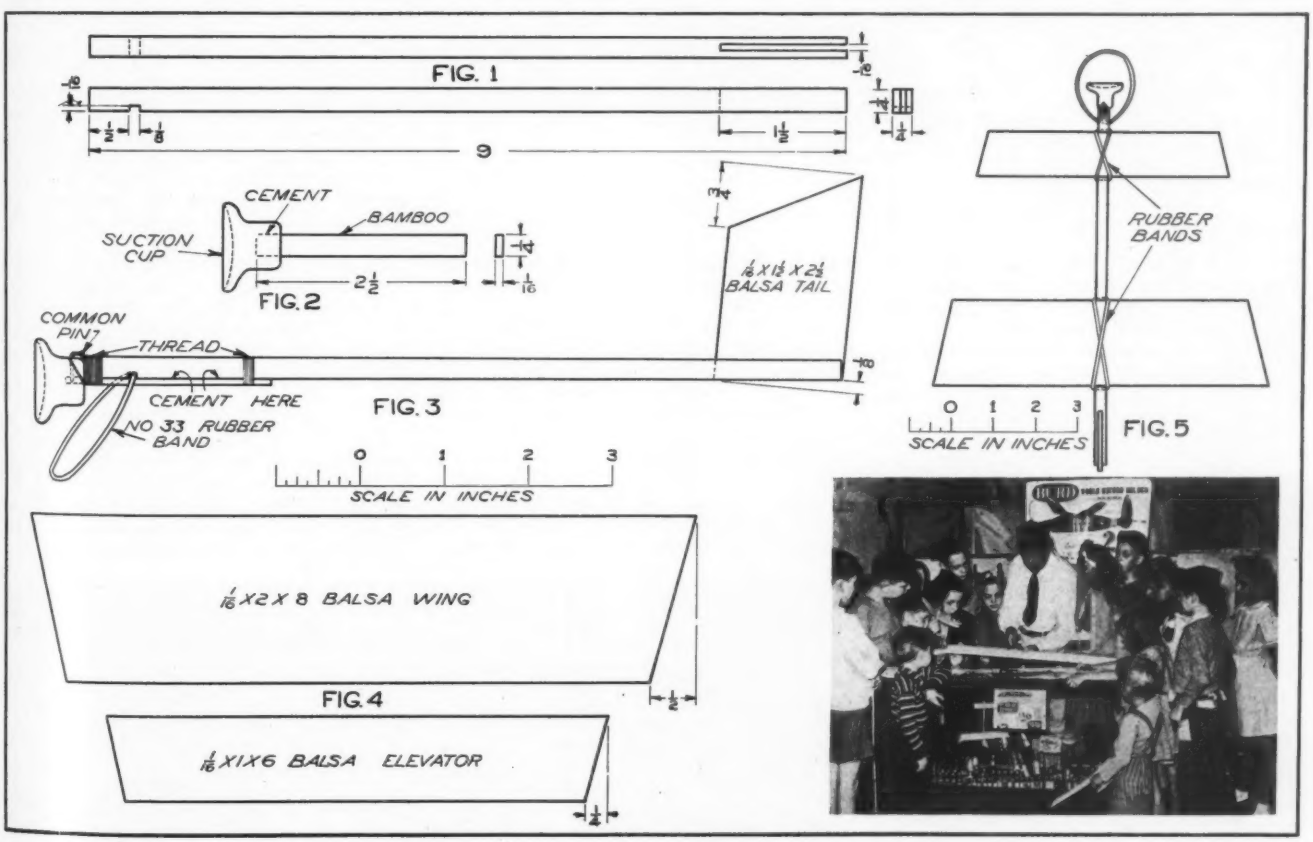
Bill of Materials

No. required	*Name*	*Size*
1	Gum-rubber suction cup	about 1-in. diameter across its front
1	Balsa body stick	¼ x ¼ x 9 to 15 in.
1	Bamboo front stick	about 1/16 x ¼ x 2½ in.
	Balsa	1/16 in. thick
	Balsa for tail	1½ x 2½ in.
	Balsa for wing	2 x 8 to 15 in.
	Balsa for elevator	1 x 6 to 12 in.
1	Ordinary pin	
	Thread	
	Cement	
	Rubber bands	No. 33, 4, and 12

Flight Procedure

In aircraft, the elements of weight, power, area, and design may be interchanged to obtain proper flight. For instance, if swift flight is wanted, the wings may be shortened, or weight may be added to the nose. If slower flight is desired, longer wings may be used, or the nose weight lightened. Hence, gliders of many different sizes, with fundamental designs similar, can have almost identical performances.

To launch the glider, place the tip of the index finger in the rubber, and with thumb and two fingers on the tail, produce the proper tension. The launching is to be done from overhead.



Terence Vincent demonstrates the making and flying of a looping glider complete within three short minutes in his hobby shop

A METHOD FOR CLASSIFYING IRON AND STEEL

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In many instances, students in drafting, machine shop, welding, or related subjects where they work with cast iron and steel, have difficulty in classifying the steels, that is, in differentiating between a low carbon tool steel and a high carbon tool steel, or possibly distinguishing the varieties of cast irons.

The chart accompanying this paper has been helpful in clarifying these particular points to the apprentice taking metallurgy. Both steel and cast iron are alloys of iron and carbon. The types of steels and cast irons, and uses to which they are put, are directly dependent upon the carbon content; thus, a steel that will have to be carburized has between .015 and .20 per cent carbon, and an ordinary tool steel will have between .60 and .90 per cent carbon. In the machine shop, three grades of steel which are in general use are cold-rolled steel which contains .20 per cent carbon, drill rod steel which contains .60 per cent carbon, and tool steel which contains .90 per cent carbon.

Besides iron and carbon, ordinary carbon steels have such elements as silicon, sulphur, manganese, and phosphorous. These elements have definite effects on steel and for this reason are very rigidly controlled during the melting process.

In the accompanying chart the main divisions are shown on the steel diagram and on the cast-iron diagram.

There is no carbon-free iron. Commercially pure iron which is marketed by the American Rolling Mill under the trade name of *Armco Ingot Iron*, has an iron content of 99.94 per cent, while the impurities including the carbon is .060 per cent. This iron has a carbon content of .015 per cent and the range would, therefore, be from .015 per cent carbon to .02 per cent carbon.

In industrial terminology, this range is referred to as 1.5 to 2 points of carbon. This means that a relationship between points of carbon and percentages exist; every .01 per cent = 1 point. Whenever the steel man would talk in terms of steel, he would use the point system.

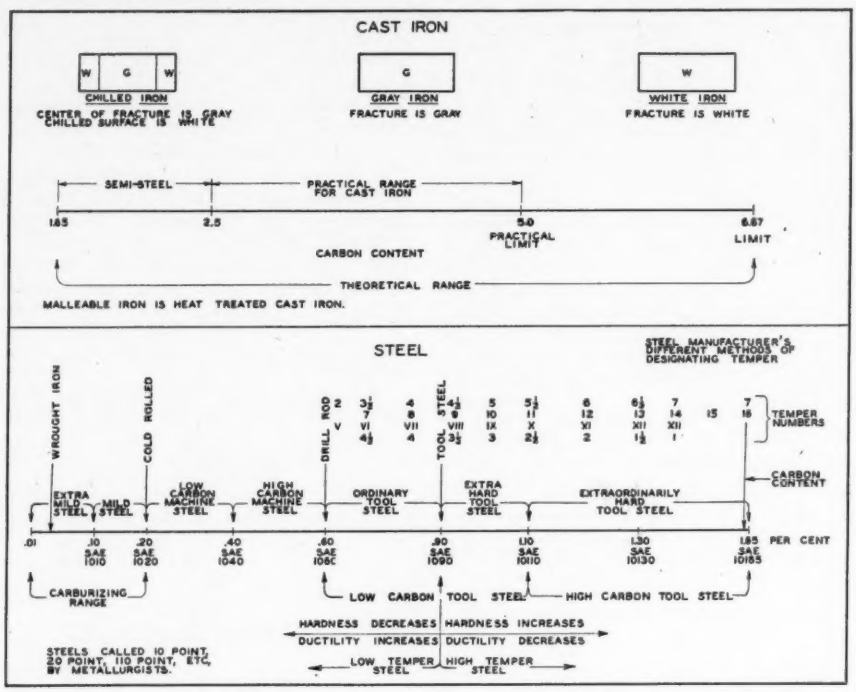
The tool steel range is roughly from 60 points to 165 points of carbon. This division point between the steels and the cast irons at 1.65 per cent carbon is purely arbitrary and may vary from 160 to 175 points according to the opinion of the individual. In this range, we have three separate ranges — the ordinary tool steel range from 60 points to 90 points of carbon, the extra hard tool steel range from 90 points to 110 points, and the extraordinary hard tool steel range from 110 points to 165 points of carbon.

In general, we may state that the tool with 90 points of carbon has a good cutting edge with toughness an important factor. As the carbon content of tool is increased, the hardness increases. It is also a known fact that as the carbon content increases, more care must be exercised in the hardening operation.

Very few tools are used that have a carbon content of 1.25 per cent or over. Many manufacturers usually denote the carbon content of a tool steel as *tempers*.

The steel companies have either numbers or letters representing these temper numbers with the variation of carbon for each temper being 10 points. Both the table and the diagram give an idea of the relationship between the carbon content and the temper numbers.

The temper should not be confused with the grade. Grade means quality whereas *temper number* means amount of carbon. Usually, the higher carbon steels have better qualities.



Carbon range of cast iron and steel

Carbon Per Cent	MANUFACTURERS A	B	C	D
1.65	7		16	
1.60	7		16	
1.55	7		16	
1.50	7	1	15	
1.45	7	1	15	
1.40	7		14	
1.35	7		14	XII
1.30	6 1/2		13	XII
1.25	6 1/2	2	13	XI
1.20	6	2	12	XI
1.15	6	3	12	X
1.10	5 1/2	3	11	X
1.05	5 1/2		11	IX
1.00	5	4	10	IX
.95	5	4	10	VIII
.90	4 1/2		9	VIII
.85	4	5	9	VII
.80	4	5	8	VII
.75	3 1/2		8	VI
.70	3 1/2		7	VI
.65			7	V

Table showing different methods of designating temper used by steel manufacturers

The temper numbers vary with the individual steelmaker.

The range for cast iron is from 165 points to 667 points of carbon. The theoretical limit of solubility of carbon in iron is 667 points of carbon, although no commercial casting has ever exceeded 500 points of carbon. The commercial range for cast iron products may, therefore, be said to be from 250 to 500 points of carbon.

In some instances, when steel scrap is used in the cupola furnace, the carbon content falls below 250 points but stays above 165 points of carbon. Theoretically, this steel is in the cast-iron range, and is commonly known as semisteel.

Types of Cast Iron

Gray iron is a cast iron whose properties are principally that of machinability, transverse strength, and damping capacity or ability to absorb sound. It has a total carbon content of 4 per cent; most of this is in the form of graphite flakes, the remainder being com-

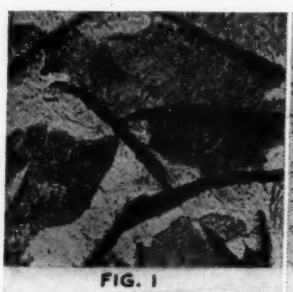


FIG. 1 Gray iron

FIG. 2 White iron

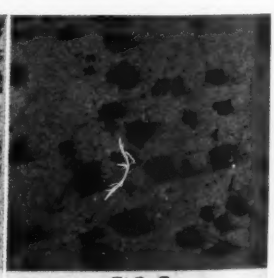


FIG. 3 Malleable iron

bined carbon. In Figure 1, which shows a photomicrograph of gray iron, the black lines are the graphite flakes. One may say that the machinability and strength is directly proportional to the amount of graphite flakes that is in the iron. Gray iron is obtained by controlling the impurities in combination with a slow coal from the pouring operations.

White iron is a cast iron that has a white fracture. This iron is usually obtained by a fast cool from the pouring operation. It has the property of extreme wear resistance, nonmachinability, comparatively high strength and brittleness. Here the carbon content is also 4 per cent and most of this is in the form of combined carbon which is very hard and brittle, the remainder being graphitic carbon. Notice that the microphotograph differs greatly from that shown in that of gray iron.

Chill iron is a cast iron that has a combination of properties — the outside surface is white iron whereas the core is gray iron. The white iron surface is for wear resistance, while the gray iron core is for shock resistance.

Alloy irons are not considered here. However, we can say that alloy iron is a cast iron to which is added during the melting process such elements as nickel, chromium, molybdenum, vanadium, etc. Adding these elements increases the strength by giving a denser iron and by reducing the size of the crystals. How the iron becomes more dense and how crystal size is reduced cannot be covered here.

Malleable iron is a cast iron. It may be hammered or twisted without fracture, and is used as a cheap substitute for steel in many instances. The casting is a white iron with about 3 per cent carbon which is then submitted to a heat-treatment called annealing. The result is a malleable iron. The carbon in malleable iron is graphite but differs from the graphite in gray iron. The graphite in gray iron is in the form of flakes (refer to Fig. 1) and can be considered as small individual cracks thus weakening the iron. Malleable iron has graphite in the nodular or spot form (the black spots in Fig. 2). The annealing operation forms the nodular graphite and this causes the casting to have properties of machinability, toughness, greater tensile strength, and malleability.

THE FLYING BIRD WINDMILL

CLIFFORD K. LUSH

Supervisor of Industrial Arts
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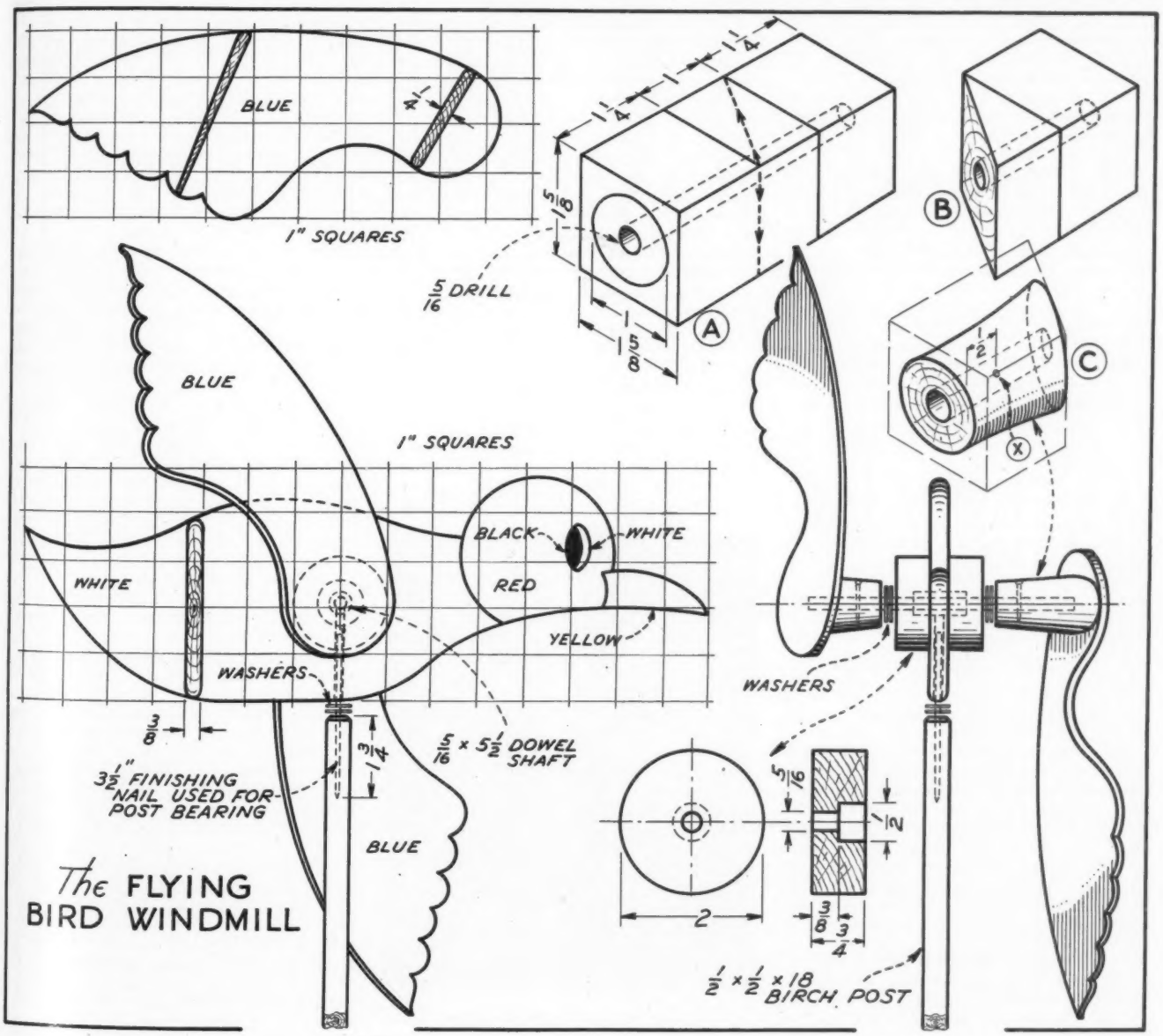
Minneapolis, Minn.

The flying bird windmill is not difficult to make. Study the drawings, the bill of material, and the procedures before cutting the stock.

To make the body, square up one edge of a piece of pine and smooth the surfaces ⅜ by 4¾ by 15 in. Cover one surface with 1-in. squares, starting from the finished edge, and transfer the design of the bird from the pattern. Saw out the design and around the back, lower edge, and top of bill. Bore a ½-in hole through the body at center of balance. Cut out the two round ¾-in. blocks 2 in. in diameter and bore a ½-in. hole halfway through, and a 5/16-in. hole the rest of the way. Then brad on the blocks in the posi-



tion shown, with the larger hole next to the body and covering the hole in the body. Make sure that the axis of the holes is at right angles to the body. Apply a white enamel undercoat and, when dry, sand smooth and enamel as indicated.

For the wings, square up one edge of each of two pieces of surfaced pine ¼ by 4 by 10¼ in. Transfer the wing design onto the surface and saw out. Then round the leading edge and wing tips, and bevel one surface of each wing as shown on the cross sections.

To make the wing flange blocks, cut a pine block 1⅝ by 1⅝ by 3½ in. Mark off two lines 1¼ in. from the ends of the block, as shown at *A*. Draw a diagonal on the surface between the two center lines. Find the center of the ends and draw a 1-in. circle on each end; then bore a 5/16-in. hole halfway into each end of the block.

Saw the block in half on the diagonal. See *A* and *B*. With a sharp knife, carve the flange from the diagonal to the circle as shown at *C*, and sand smooth.

Drill a 1/16-in. hole through the round end ½ in. in from the end. See *X* at *C*. Cut a piece of 5/16-in. dowel 5½ in. long, and glue and brad the wings onto the flange, with the acute angle of the flange at right angles to the length of the wings. Carve the rectangular end of the flange to blend into the design of the wing end. Finish the wings and flanges the same as the body, but use blue enamel for the final coat.

You may use either of two procedures to make the post support. For the first, assemble the wings to the body temporarily; find the center of balance on the underside of the bird, and mark it. Drill a hole about 1/64 in. larger than the diameter of the post bearing, into the body of the bird at the center of balance and toward the center of the axle hole. Then cut and square a piece of birch ½ by ½ by 18 in., and chamfer all edges ⅛ in. Select a long nail (about 4 in.) for the post bearing, and drill a hole a shade smaller than the diameter of the nail and 1½ in. into one end of the post. Force the nail into the post, cut off the head, and enamel the post black.

For the second procedure, cut a piece of ¾ in. diameter thin wall conduit, 30 in. long. Fit a 2-in. birch plug firmly into one end. Drill a hole a shade smaller than the diameter of a 3½ in. finishing nail. Force the nail 1¼ in. into the plug and saw off the head. Then flatten 6 in. of the opposite end of the conduit on an anvil. Bore two holes 4 in. apart for the supporting screws or nails.

Adjusting and Assembling

Reassemble the project, and, with a sharp awl or brad, make a center mark on the dowel through one wing flange hole at *X*. Take off the wings and drill a 1/16-in. hole through the dowel at the center mark. Either brad the wing flange on the dowel, or use a small curtain hook. Reassemble the bird with washers on the post bearing and wing bearings. Now balance the wings. With someone carefully holding the assembly, drill the second hole through the flange hole and through the dowel. Fasten the second wing securely with a large brad or small curtain hook.

Metal Bearings for Wing Axle

Metal bearings will permit the wings to turn with less air force than wooden axles, and in addition the axles will not wear so rapidly.

If you wish to use metal bearings, bore a ⅜-in. hole all the way through the side blocks; then bore a ⅜-in. hole in a scrap piece of ¾-in. birch. Cut two disks, 1½ in. in diameter from a piece of tin. Drill a ⅛-in. hole through the center of each disk. Place a disk over the hole in the scrap block and force a large burr in the disk hole by hammering a ⅜-in. or larger center punch through the disk hole.

File the burr edges even, and carefully ream out the hole. Drill two 1/16-in. nail holes on opposite sides of the burred hole, and nail the disks onto the side blocks with the burr in the block hole.

HOW TO SELECT AND SPECIFY MODERN SANDPAPER

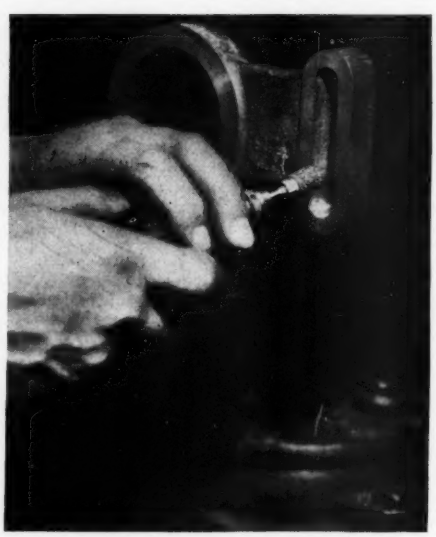
H. G. SEAMAN

Behr-Manning Corp.
Troy, N. Y.

Into the pattern of our nationwide war operations, there has penetrated a strong appreciation of good quality tools. Gone, and we hope forever, is the practice of shopping for something cheaper. The need is for the best — the demand is for the best. Curious how in times of emergency, good quality finds itself . . . how tools, like men, are judged by what they do.

Also in this pattern we see the merging of educational activities with war work and military requirements. Boys — perhaps we should refer to them as young men — are students today. Tomorrow, or as soon thereafter as possible, our country wants them; not all for front-line fighting, but for skilled operations and for apprentice work far behind the lines — in factories; in arsenals; in tank, airplane, motor, and instrument plants; in boatbuilding establishments and in a myriad of other essential war industries. Even among those who are to engage in active warfare, there is great need for mechanical understanding, talent, and practice.

Tools and men — the sinews of war. The correct use of the former and the development of the latter are to a very great degree, in the hands of our trade schools and our industrial-arts and vocational-training classes.



Cleaning a casting with a Metalite spiraband

It is a grim business now, not just the manufacture of a few household pieces. What is needed most is direct, forceful instruction in the methods used in industry and with the tools used by industry.

It would be interesting to consider a number of these tools, but since the purpose of this article is to deal with the uses and the *misuses* of Coated Abrasives (sandpaper in its various forms), it is well to stick to that subject.

Some school systems buy the cheapest sandpaper or emery cloth that can be bought. No consideration is given to quality nor to the volume of material consumed. This may be due to the shortsightedness of purchasing departments and supervisors or to *dollar-conscious* decisions by school boards, but it is also due in great measure to lack of knowledge or understanding of what constitutes good sandpaper and how to order or requisition it. For this latter condition the manufacturers of coated abrasive may well be held responsible.

The cheapest sandpaper is flint paper; the cheapest abrasive cloth is emery cloth; cheap to buy because they are nontechnical products made to sell over the counters of hardware and paint stores for odd, off-hand sanding jobs around the house; expensive to use because the cutting or abrading properties of these two abrasives are the lowest of all commercial abrasive products in use today. Their ratio of sanding performance to the dollar and to the man-hour time consumed in using them is far lower than that of any of the technical abrasive papers and cloths referred to in the following paragraphs.

Even among flint and emery products there are recognized degrees of quality which pretty well follow the price trend. Can you imagine an airplane plant using tin chisels — and the cheapest ones in the bargain? Well, many school systems do the equivalent of just that when it comes to the buying of coated abrasives.

For woodworking, the correct abrasive usually will be found to be garnet, reddish-brown in color, much harder than flint, sharper, and capable of producing far more work. Moreover, garnet is supplied in a variety of paper backings selected for their strength or their pliability, whichever the need may be. The glue or bond is of better grade and there are variations in coating; that is, Openkote for chip clearance and Closekote for tough work, which add greatly to the range and product selection for any given job.

For some types of machine sanding, that is, drum and disk sanding and belt sanding on flat work, an especially heavy 130-lb. rope paper backing gives assurance of long wear and high production, while for the belt sanding of edges, rounds and other narrow contact work, heavy cotton cloth backing is available. Mouldings are sanded with belts of lighter, more pliable cloth, and an extremely light, very pliable finishing cloth is made for work on intricately curved surfaces. In fact, many degrees of flexibility are required by the woodworking industry to handle all of the special operations with which they come in daily contact.

Harder and tougher even than garnet are aluminum oxide abrasive papers and cloths. These are the accepted products for high-speed production operations in our largest woodworking plants. (See Chart No. 1 on opposite page.)

CHART 1 — SANDPAPERS FOR WOODWORKING

HAND SANDING	Order in reams of 480 sheets		Backings { "A" weight - light, soft & very flexible; "C" weight - medium - flexible; "D" weight - slightly heavier - flexed	
PRODUCTS	Garnet (Cabinet) Paper	Garnet Finishing Paper	Speed-Wet Waterproof Paper (Silicon Carbide)	Flint Sandpaper
FORM	9" x 11" Sheets	9" x 11" Sheets	9" x 11" Sheets	8½" x 10½" and 9" x 11" Sheets
GRITS AVAILABLE	#4/0 very fine thru #3½ Coarse	#8/0 very fine thru #0 Coarse	#600 very fine thru #150 Coarse	#4/0 very fine thru #3 Coarse
COATINGS	Closekote & Openkote	Openkote	Closekote	Closekote
BACKINGS	Medium weight - Flexible	very light, soft & Flexible	Medium weight - Flexible Light weight - very flexible	Medium weight
HOW TO USE AND WHERE	Dry, by hand, for sanding wood in the white	Dry, or with oil by hand on finishing coats	With water, by hand or with mechanical rubbing machines; the ultimate in finishing paper for the finest of finishes.	Dry, by hand, for soft pitchy wood, shellac, soft or tacky finish coats & for removing old paint coats.
REMARKS	Garnet is the preferred abrasive for wood: Closekote is recommended for hard wood & for edge or end sanding; Openkote is better for soft or pitchy wood.		Garnet Waterproof paper is also available in 9" x 11" sheets-8/0-0 for water rubbing.	Flint sandpaper is not a production tool.
MACHINE SANDING (ALL DRY SANDING)	Order in rolls, discs, belts, bands giving complete dimensions on every order: Rolls are 50 yds. long - give width; other forms are considered specialties; give outside diameter & center hole for discs; give length & width of belts; give width & diameter of bands.			Cloth Backings "X" = Heavy weight drills "J" = Light weight jeans Finishing Cloth is so marked.
PRODUCTS	Garnet Cloth	Garnet Paper	Adalox Cloth (Aluminum Oxide)	Adalox Paper (Aluminum Oxide)
FORMS	Rolls-Discs-Bands-Belts	Rolls-Discs-Belts	Rolls-Discs-Bands-Belts	Rolls-Discs-Belts
GRITS AVAILABLE	#4/0 very fine thru #3 Coarse	#4/0 very fine thru #3½ Coarse	#4/0 very fine thru #3 Coarse	#10/0 very fine thru #3 Coarse
COATINGS	Closekote & Openkote	Closekote & Openkote	Electrocoated-both Closed & Open	Electrocoated-both Closed & Open
BACKINGS	"X" weight - heavy; "J" weight-light-flexible; Finishing Cloth - lighter Extremely flexible	130 lb. Heavy Rope Paper	"X" weight - heavy; "J" weight-light-flexible; Finishing Cloth - lighter Extremely flexible	130 lb. Heavy Rope Paper
HOW TO USE AND WHERE	General Machine Sanding "X" wt. for heavy belts "J" wt. for moldings & Curves Finishing Cloth for intricate Moldings & Curves.	On all types of Drum Sanders and Disc Sanders but on Belt Sanders only where flat work is sanded under medium pressure.	Aluminum Oxide Paper and Cloth are preferred over Garnet for use in most modern woodworking plants where equipment operating at higher speeds and greater efficiency on the hardest woods, is keyed to give maximum production and at the same time, to get the greatest possible value out of the Coated Abrasives used.	

CHART 2 — COATED ABRASIVES FOR METAL WORKING

HAND SANDING	Order in reams of 480 sheets or in Handy Rolls as indicated below.					
PRODUCTS	Aluminum Oxide Cloth	Aluminum Oxide Paper	Silicon Carbide Paper	Waterproof Paper (Silicon Carbide)	Emery Cloth	Crocus Cloth
FORM	9" x 11" Sheets Narrow 50 yd. Rolls	9" x 11" Sheets	9" x 11" Sheets	9" x 11" Sheets	9" x 11" Sheets	9" x 11" Sheets
GRITS AVAILABLE	320 Very Fine thru 24 Very Coarse	9/0-320 Very Fine thru ½-60 Coarse	320 Very Fine thru 100 Coarse	600 Very Fine thru 60 Coarse	3/0 Vy Fine thru 3 Very Coarse	Very Fine (One Grit Only)
COATINGS	Electrocoated-Closed	Electrocoated-Open	Openkote	Closekote	C Closekote	Closekote
BACKINGS	Flexible Cloth	Light & Med. Weights	Light & Med. Weights	Light-Very Flexible Medium-Flexible	Medium	Medium
HOW TO USE AND WHERE	Dry with oil or with gasoline by hand for all general metal finishing & polishing work. Used in sheets, small pieces or in strips for cylindrical work.	Dry or gas sanding by hand on metal surfaces where the strength of cloth backing is unnecessary: Also for hand work on metal finishing materials.	Dry or gas sanding by hand on such finishing materials as surfacers, fillers, lacquers & enamels, preparatory to final finishing: Also used on plastics.	Water sanding & rubbing on all finishing materials, by hand & with pneumatic rubbing machines. Used with plenty of water, it is the ultimate in fine finishing papers.	Dry or with gas or oil, by hand for odd job work and polishing on metal.	Dry by hand for metal polishing only on brass, copper and other soft metals.
REMARKS	Aluminum Oxide cloth is industry's choice for all hand jobs of metal cutting and finishing, superseding emery cloth in all but the finest of finishing and polishing work. Generally used dry in 9"x11" sheets and in narrow strips. For the latter purpose it is furnished in narrow rolls-50 yd. rolls, individually boxed. Aluminum Oxide sheets and handy rolls are pre-flexed and ready for the job. Emery cloth is unflexed.					
MACHINE SANDING						
PRODUCTS	Aluminum Oxide Cloth	Aluminum Oxide Fibre Combination	Aluminum Oxide "R" Weight Discs	Silicon Carbide Cloth	Waterproof Silicon Carbide Cloth	
FORM	Rolls, Discs, Belts, Spirabands, Cones	Discs(only) for Portable Sanders	Discs for stationary Disc Sanding Machines	Rolls, Discs, Belts	Belts	
GRITS AVAILABLE	320 Very Fine thru 24 Very Coarse	320 Very Fine thru 16 Very Coarse	120 Fine thru 16 Very Coarse	320 Very Fine thru 24 Very Coarse	500 Very Fine thru 24 Very Coarse	
COATINGS	Closekote	Closekote & Openkote	Closekote (extra heavy)	Closekote & Openkote	Closekote	
BACKINGS	Heavy "X" Weight Drills Cloth	Fibre comb (X wt. cloth joined with heavy fibre	Heavy "X" Weight Drills Cloth	Heavy "X" Weight Drills Cloth	Heavy "X" Weight Drills Cloth	
HOW TO USE AND WHERE	Dry for general metal sanding and finishing by machine: Most types of metal and forms of sanders: Particularly metals of high tensile strength.	Dry for cutting down welds and sanding out other surface imperfections with portable electric, air or flexible shaft sanders.	Dry for precision metal cutting on small work which can be brought to the floor type grinder.	Dry for belt and disc sanding of glass, tile, ceramics, plastics, leather, composition, rubber and soft metals.	With water or other lubricant for sanding glass, tile, ceramics, plastics, composition, rubber, & critical metals which are adversely affected by the frictional heat generated in dry sanding.	

For metal sanding (Chart No. 2), emery has long since given way to the tougher, sharper, faster cutting artificial aluminum oxide abrasive, just as flint has fallen prey to the superiority of garnet. Emery, a compound of natural oxide of alumina, iron ore, and other nonabrasive elements, contains about 60 per cent aluminum oxide, whereas artificial aluminum oxide is a cutting tool, which contains about 97 per cent pure aluminum oxide.

Where no cutting is to be done, that is, where the action is merely to polish or burnish without removing stock, emery is satisfactory as is also crocus (oxide of iron). In fact, it is the iron oxide in both of these abrasives which gives them their polishing properties.

Coated abrasives are vital to the development of both wood and metal finishes. In woodworking, for example, it is usually desirable to produce a high gloss or satin rubbed finish of depth and luster and free of imperfections. Many finishing formulas exist for such work. Whatever the system, whether filler, stain, varnish, and wax; or sealer, lacquer, and wax; the beauty and richness of the final finish are directly dependent upon the quality and the number of coats applied *plus* the amount of rubbing performed. And this is equally so in the development of metal finishes.

Such rubbing is done with fine abrasive paper, either by hand or by use of air-driven rubbing machines. In any event, a lubricant or a rubbing compound is used. In wood finishes, rubbing oil and loose pumice or rottenstone are frequently employed along with fine garnet finishing paper. Where water can safely be used, waterproof sandpaper is favored. In metalwork, rubbing with waterproof sandpaper and water is by far the preferred method. Certain it is that these are technical applications in which there is *no* room for cheap sandpaper.

Burring the edge of a hole with a Metalite cloth slatted disk

In industry there is, of course, a multitude of other uses for coated abrasives — both general and special in character. Few of them are, however, of sufficient importance to schoolwork to be more than touched upon in an article of this kind. Some of those which might be of greater interest are the use of waterproof abrasive cloth belts for the wet sanding of glass, tile, ceramics and other friable materials, along with plastics and such metals as are easily discolored or distorted by the frictional heat of dry sanding. For most of this work, special equipment is required and direct application assistance should be obtained from the manufacturers.

There are also many operations peculiar to certain sections or regions of the country, for example, shoe manufacturing and other work with leather; felt-hat manufacturing, automotive manufacture (in normal times), and car reconditioning. On all of these specific data will gladly be furnished.

The charts provide an opportunity for the instructor to review what industry has been using in sandpaper, including the latest developments for war work. All of these findings also are available for school shop use.

Shown also is a sample requisition properly listing a few of the coated abrasive items used by educational institutions. The time for instructors and school purchasing departments to use this information is now. The time for school boards and supervisors to put their stamp of approval on *quality sandpaper* is likewise now. This is not a plea for the purchase of any given brand of product, but rather an earnest effort to help the teacher make the school's sandpaper dollar go further and at the same time to implement properly our mechanics of tomorrow.

The question for each man to settle is not what he would do if he had the means, time, influence, and educational advantages, but what he will do with the things he has.

— *Hamilton Wright Mabie*

GARNET SILICON CARBIDE ALUMINUM OXIDE	FLINT PAPER	EMERY CLOTH	
400 or 10/0			
320 or 9/0			Very Fine
280 or 8/0			
240 or 7/0	5/0		
220 or 6/0	4/0		
	3/0		
180 or 5/0		3/0	
150 or 4/0		2/0	Fine
	2/0		
120 or 3/0			
	0	0	
100 or 2/0			
	½	½	
80 or 0		1	
	1	1½	Medium
60 or ½			
		2	
50 or 1	1½		
	2	2½	
40 or 1½			
	2½		
36 or 2			Coarse
		3	
30 or 2½	3		
24 or 3	3½		

GRADING CHART FOR COATED ABRASIVES

Grading chart

Page 5

BLANKTOWN BOARD OF EDUCATION
BLANKTOWN, N. D.

See Paragraph 16—"BID CONDITIONS" For Cash Discount Information

ITEM No.	Supply Dept. Cat. No.	SPECIFICATIONS	EXTENSION $	cts
		HARDWARE AND SUNDRIES		
1	1672	ABRASIVES:		
		ABRASIVE CLOTH: 50 yard rolls Aluminum Oxide		
		10 Rolls—1⅛" wide No. 60 $_____ per roll		
		10 " 1⅛" " " 80 _____ " "		
		10 " 1⅛" " " 100 _____ " "		
		10 " 2" " " 80 _____ " "		
2	1674	ABRASIVE CLOTH 9" x 11" sheets Aluminum Oxide		
		2 Reams No 80 $_____ per ream		
		2 " " 100 _____ " "		
		5 " " 150 _____ " "		
		3 " " 180 _____ " "		
3	1679	ABRASIVE PAPER: 9" x 11" sheets Garnet Cabinet		
		5 Reams No. 1 $_____ per ream		
		5 " " ½ _____ " "		
		8 " " 0 _____ " "		
		4 " " 2/0 _____ " "		
4	1679	ABRASIVE Paper 9" x 11" sheets Garnet Finishing		
		$ per ream		

Fine example of school sandpaper requisition

CARVING BOOK ENDS

AMANDA WATKINS
The Berry Schools
Mt. Berry, Ga.

At one time or another every boy and girl, man and woman, is possessed with the idea of whittling and carving. Certainly this desire should be satisfied with making something

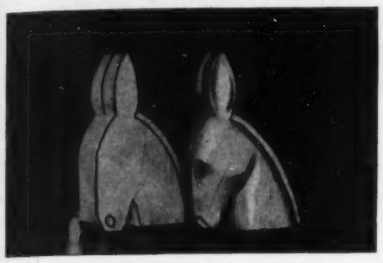


Fig. 1

useful. Book ends are ideal for the beginner and many different designs may be created. Cutting out a pair of mulehead books ends, like the pair shown in Figure 1, takes very little time and the thrill of making the mules

Fig. 2

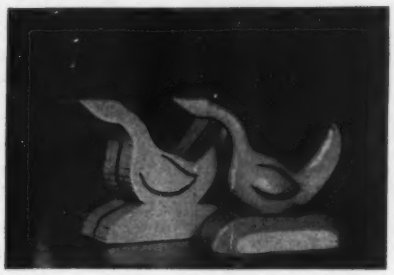


Fig. 4

just like one wants them, means much to every carver. As the work on a model goes along, new ideas may come, thus bringing individuality into the work. The best-looking book ends are the ones with strong lines and artistic curves. The first mules we made had the eyes cut into the wood; now we show only the slope for the eyes. Book-end designs may be worked up with rough cuts using no sandpaper to finish the carving, or the work may be finished by sanding until the surface is smooth.

There are other things besides book ends that may be attempted. The students at Berry College, for instance, whittle animals, figures, trays, bowls, and wall plaques. The boys and girls doing this work are paid by the hour and the money they earn helps pay their way

Fig. 5

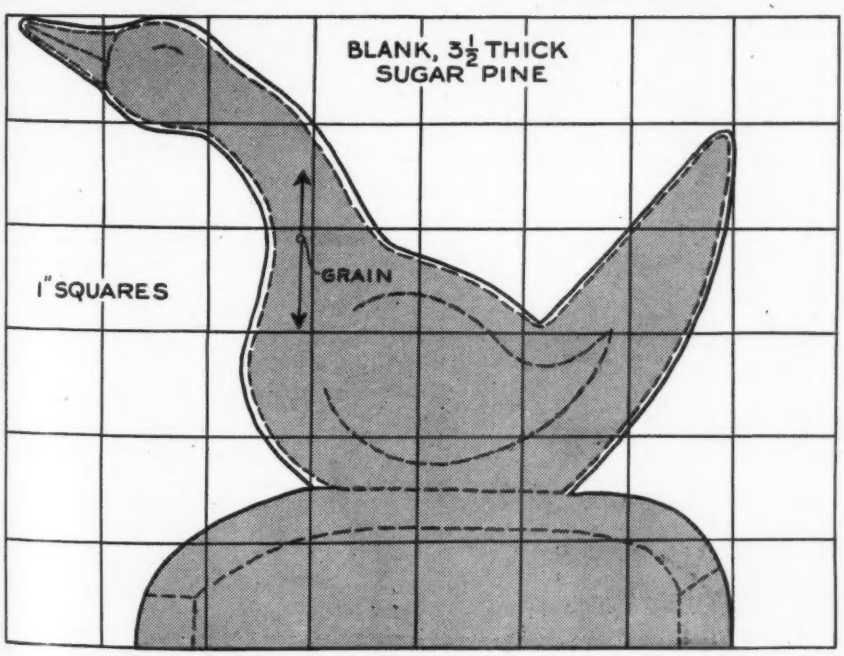


Fig. 3. The pattern

through college. Carving is such a creative work they do not get tired of making the same objects over and over. They do try, however, to make each piece as individual as possible. No two animals or figures, cut from the same pattern, are ever alike.

The first step in carving a pair of book ends or any other object, is to draw a pattern

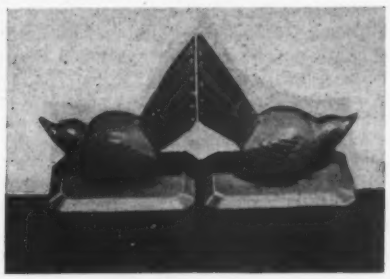


Fig. 6

such as is shown in Figure 3. Draw the side view and decide on the thickness of the block. Use sugar pine for the wood as it cuts nicely and takes a good finish.

To carve the swan book end, for instance, draw a line through the middle of the block to help keep the carving symmetrical. Next draw the wings, tail, neck, and head of the

Fig. 7

swan on the block as shown in Figure 3. With the large blade of the pocketknife cut away the excess wood from around these pencil lines. Do not finish any one part of the swan but keep it all in a rough state until the proportions seem satisfactory.

Then with the small blade of the knife, begin shaping the head, neck, wings, and tail. Keep the lines of the swan as simple as possible and remember to give a graceful curve to the tail, neck, and wings. A few cuts on the wings may make the carving more interesting, but the carver must be the judge of that. After the shape of the swan has been satisfactorily carved, begin to sand it using 4/0-150 sandpaper first, and finish the process

Fig. 8

with 6/0-200 sandpaper. Be very particular about the sanding. There must be no scars or scratches on the wood because they show plainly after the finish has been applied.

To make the book end heavy, gouge out a space 3 by 2 by ½ in., and pour hot lead into the cavity.

For a good finish, apply three coats of any good floor wax. Cut a piece of felt the size of the bottom and glue it in place. The swans are then ready to guard books and to add distinction to any room. Figures 5, 6, 7, and 8 show other patterns of book ends that are beautiful as well as useful.

ELECTRIC BRANDING DEVICE

E. A. RERUCHA

Community High School
Franklin Park, Ill.

This simple and effective electric brand for branding wooden objects may be constructed at very little expense.

Obtain two pieces of asbestos slate large enough to accommodate the brand layout and allowing about ¼-in. margin along the sides and ½ in. at the ends. Drill ⅛-in. holes in the ends of each piece as shown in Figure 1. Countersink the holes for No. 6 flathead screws in one of the pieces.

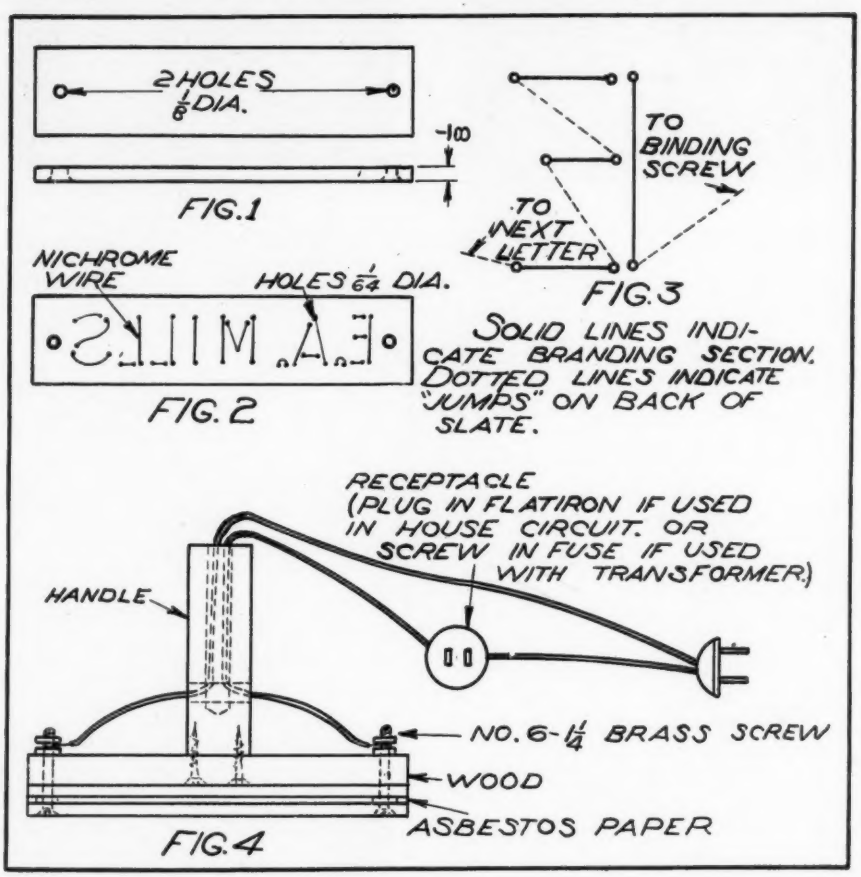
Lay out the brand in reverse on the piece and side with the countersunk holes, marking out letters as shown in Figures 2 and 3. Each letter is made up of sections formed by threading nichrome wire through holes on the letter outline. Drill holes 1/64 in. in diameter on the outline as suggested in Figures 2 and 3. Wire, such as is used in toaster and heater elements, is used for the burning element. This may be purchased or a piece may be used from a discarded element.

Attach one end under one of the binding screws and thread the other end through each letter, being careful that sections do not short each other out by touching or crossing. With a little study it will be possible to make nearly all *jumps* on the back of the asbestos slate in such a way that insulation will not be required. See Figure 3. If, however, insulation is necessary, a piece of mica should be placed between the wires.

When the brand outline is completely threaded, fasten the other end of the wire to the remaining binding screw. Cover the back of the branding element with two or three layers of asbestos paper, making holes in it for the binding screws. Place the other piece of asbestos slate on top of the asbestos paper.

A block of wood ½ in. thick and of the same dimensions as the asbestos slate pieces, is cut and drilled to fit over the screws. A hollow handle is attached with screws as shown in Figure 4. Attach handle block over binding screws with nuts. Thread a piece of flexible cord through holes in handle and attach ends to binding screws. Tape binding screws. A receptacle is connected in series in the cord as shown in Figure 4 for attaching a flatiron, toaster, or other household devices of similar capacity for a resistance. In this manner the device may be used on the 110-volt house circuit. The device may also be used directly on a 6-volt toy transformer.

To use, simply plug into the circuit and apply the brad to the object to be branded. The name or design will be burned into the object.



Electric branding device

THREAD GAUGES — OPERATION DRAWINGS

WILLIAM A. DE VETTE

Technical High School
Erie, Pa.

At the present time, when so many men are teaching machine-shop practice for the first time, many of them without a great amount of teacher training, who are nevertheless doing a great piece of work, projects which will save time for the teacher should be welcome.

In most of the defense classes there is what is called a revolving enrollment, trained men leaving and new men coming in. Under such conditions it is difficult to carry on group instruction. However, it is also difficult for the teacher to give each man the instruction he needs before each operation.

The operation drawing takes much of this load from the teacher. The operation drawing tells the student what he is expected to do, step by step, from the rough stock to the finished article. It discloses the reason for some of the things he is required to do but which would otherwise be difficult for him to understand. Furthermore, in many cases the student can go from step to step until he reaches some point which is not clear to him before he asks the teacher for assistance.

This idea is, of course, far from new. As far back as *the war to end all wars* the writer made a series of operation drawings for shells, in fact, the series consisted of over 80 drawings for a single shell, from the rough forging to the finished projectile.

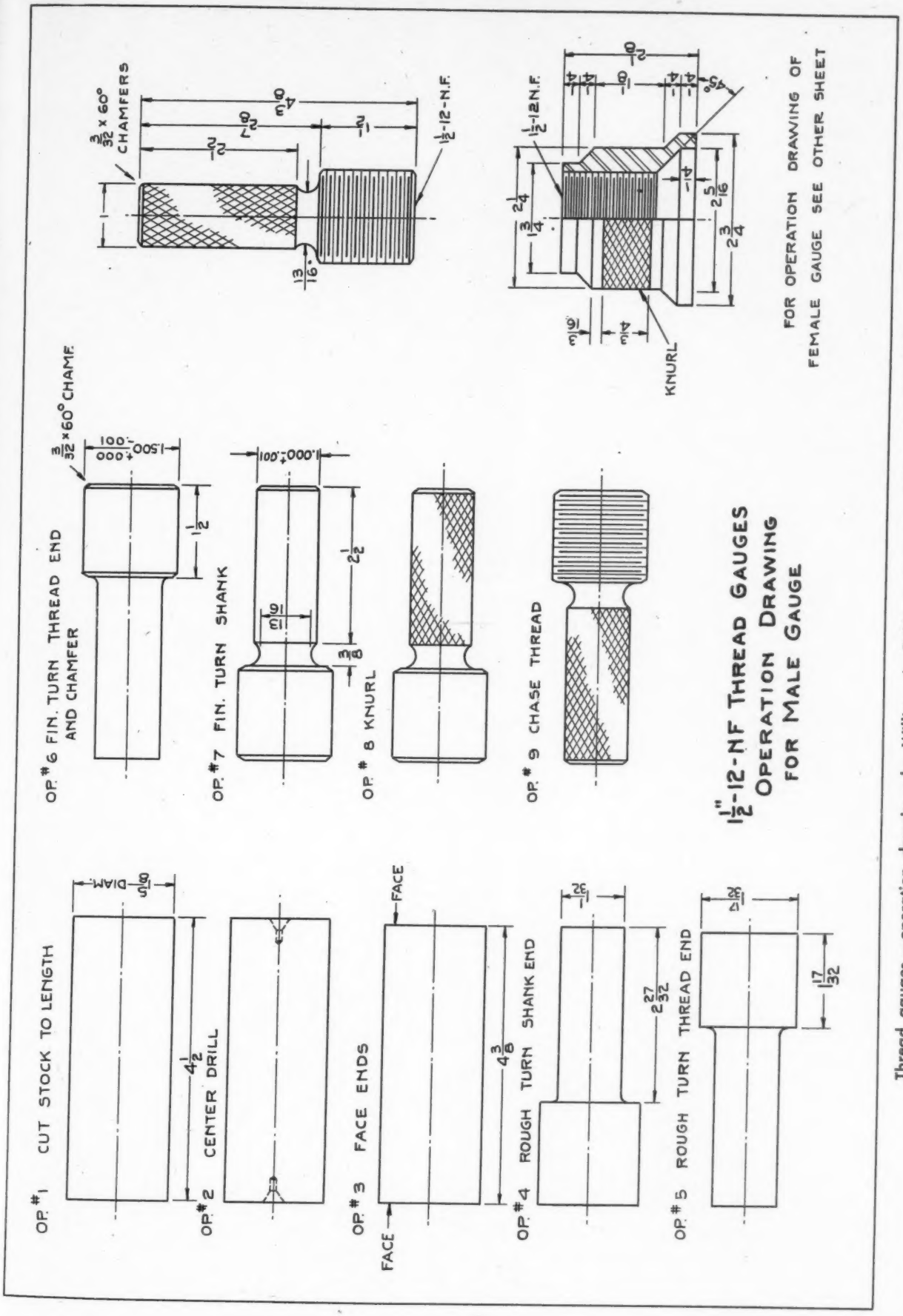
The trouble with many of the operation drawings made for school use may lie in the fact that there is a lack of frank exchange of ideas between the drafting and shop instructors. The shop teacher needs the good will of the drafting instructor or he feels that his chance of obtaining drawings at all will be slim. Therefore, he does not criticize the first print as he really should. The drafting teacher on his part hesitates to ask the shop teacher for the information he should have in order to make the drawings as helpful as they could be, this for fear the shop teacher will consider the drafting teacher ignorant of facts which to him are self-evident. No drafting instructor can be expected to know all of the kinks which are of everyday occurrence in the shop.

At our own school we have overcome this drawback until now the drafting teacher and shop teacher *go after* each other with a red pencil and no conscience, with complete good will and to the mutual advantage of both.

One of the results is shown in the accompanying drawings. I would hesitate to place the original next to it even as a horrible example.

In the first drawing some of the views combined two operations which the writer considered as one. In some of the operations the piece is placed in the lathe with the ends reversed. This was not taken into consideration until the shop instructor convinced the writer how little he knew about teaching shop practice. No thought had been given to the

(Continued on page 263)


1½"-12-NF THREAD GAUGES
OPERATION DRAWING
FOR MALE GAUGE
FOR OPERATION DRAWING OF FEMALE GAUGE SEE OTHER SHEET
KNURL
OP. #1 CUT STOCK TO LENGTH
OP. #2 CENTER DRILL
OP. #3 FACE ENDS
OP. #4 ROUGH TURN SHANK END
OP. #5 ROUGH TURN THREAD END
OP. #6 FIN. TURN THREAD END AND CHAMFER
OP. #7 FIN. TURN SHANK
OP. #8 KNURL
OP. #9 CHASE THREAD

Thread gauges — operation drawings by William A. DeVette, Instructor, Technical High School, Erie, Pa.
(For description see page 260)

1½"-12-NF Thread Gauges
Operation Drawing
For Female Gauge
For operation drawing of male gauge see other drawing
OP. #1 Cut stock allow ½" for chucking
DIAM.
2¾
OP. #2 Chuck to run true rough turn complete and face
OP. #3 Fin. turn 2¾ diam. angles and steps
OP. #4 Center drill and drill for boring (calculate size of drill required)
DRILL
OP. #5 Bore for root diam. (calculate diam. of bore)
BORE
OP. #6 Chase threads
1½-10 N.F
OP. #7 Cut off to required length
OP. #8 Place on male gauge bore and turn inside angle and knurl
KNURL
CLAMP
WASHER
OP. #9 Break corners and polish complete

Thread gauges — operation drawings by William A. DeVette, Instructor, Technical High School, Erie, Pa.
(For description see page 260)

(Continued from page 260)

fact that the student at the lathe was working with a machine totally new to him, that he was learning to handle the controls, to read blueprints, to measure with instruments of greater accuracy than ever before, and to produce an acceptable product as a step toward better employment, all at the same time. From this viewpoint it becomes evident that the drawings should be made as easy to read as possible.

The two drawings are offered as samples of what can be accomplished with operation drawings and it is hoped that they may be followed by others of a similar nature.

THE SCOUT WATCH FOB

E. LE ROY LONGLEY

Baltimore, Md.

Boy Scouts, and other boys too, like to wear something they themselves have made. Scouts, of course, like to have something emblematic of their organization, and it is for this reason that this project has been designed, and dedicated to them.

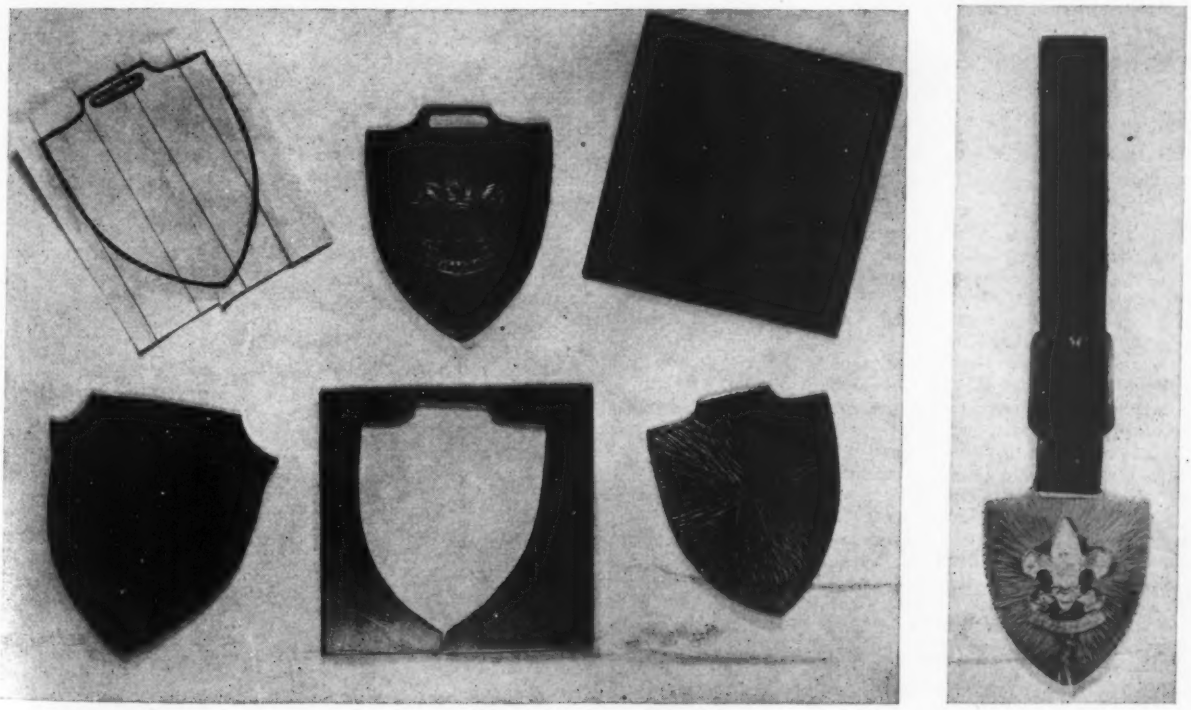
Besides having this piece of his handy work to wear, the scout will find in its working there are incorporated three of the requirements for his merit badge in metalwork, namely, soldering, hammering, and sawing.

The fob may be made of copper, brass, nickel, silver, or sterling silver, according to the maker's desires. In any of the metals about 18-gauge B. & S. will be most suitable. Prices will range approximately as follows: sterling silver, 35 cents; nickel silver, 4 cents; copper and brass, 2 cents. The pins vary in price according to size and class, the range being from 5 to 15 cents. The leather strap can be purchased for 10 cents or may be made.

Now let us go into the design of the fob. This may be made by folding a piece of paper in half and cutting a shape to suit. Many shapes may be made in this way, but the one I have found to appeal greatly to boys, and is appropriate, is a shield. This may also be varied to suit the taste. The size is about 1¾ in. square.

The surface may be enriched in several ways. It may be etched, pierced, or hammered, or it may be left plain. If left plain, the surface may be enriched by pressing the metal gently against the end of a revolving cork to which has been glued a piece of emery cloth. This makes a very attractive job. The following method of procedure is ideal, and has met the approval of many boys.

1. Plan the shape of the fob.
2. Clean the metal with steel wool, or buff it.
3. Paint the surface of the metal with a water white.
4. Transfer the outline design to the metal by means of carbon paper.
5. Trace over the design carefully with a scratch awl.
6. Saw out the design with a jeweler's saw.
7. Drill ⅛-in. holes for strap slot.
8. Saw strap slot.
9. File all edges.
10. Spot. Here let me describe a method of spotting or faceting that is interesting. Either secure a hammer that will make a long narrow spot, or grind an old riveting or setting hammer to the desired shape. After grinding, polish with emery, then tripoli, and burnish with rouge. A smooth bright edge or surface is essential. The spotting is done from the center of the fob out, radially, giving the appearance of the rays of the sun.
11. Now add the part that brings this job close to the scout's heart. The scout pin is prepared and sweat soldered to the center of the fob. Soldering paste may be used as a flux.
12. Clean the job with acid or steel wool or use a scratch wheel on a buffer.
13. The job may be lacquered bright or colored with chemicals. Butter of antimony (antimony chloride) may be used for coloring brass. After the metal has been colored, steel wool or the scratch brush may be used for high lighting the sunray effect.



Making a scout watch fob

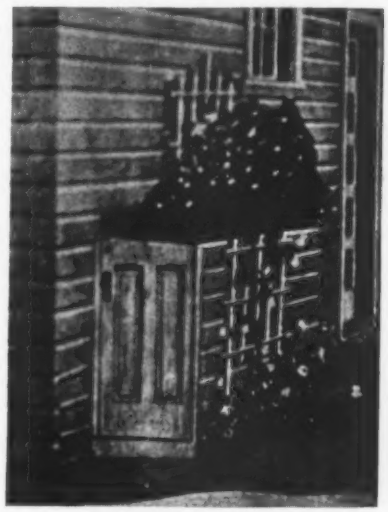
A BICYCLE GARAGE FOR DEFENSE

D. C. MARSHALL

Junior High School

Manhattan, Kans.

Now that the war has caused so many to become bicycle riders, the problem of where to keep the bike has become quite an issue. The school shop can help solve the problem by encouraging the boys to make bicycle



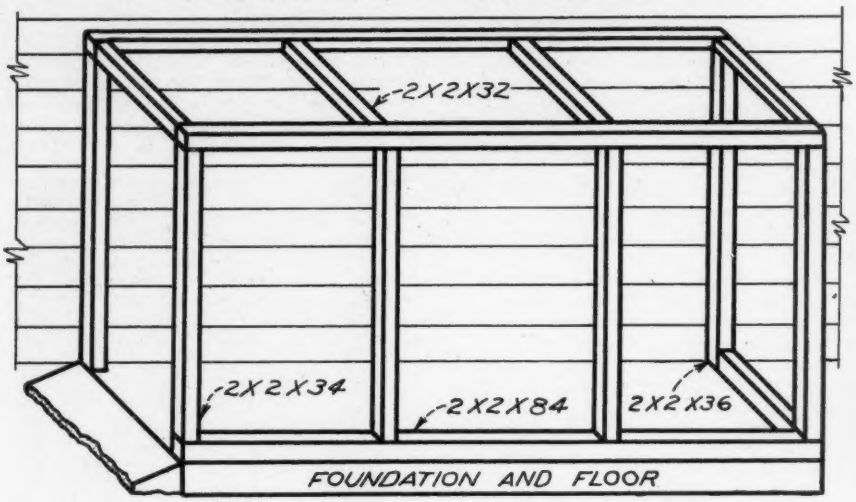
The bicycle garage

garages. Most of the work can be done in the school shop, and it is not much of a job to take the knocked-down garage home and assemble it. The side frames can be assembled and the siding nailed on and all of the other frame pieces cut to fit. If bolts are to be used to hold the parts together, the holes also can be bored for them.

The floor may be a problem for some students but if several garages are to be built, the class can be taken out to lay the floors for all of them in one trip. The cement may be mixed on the garage floor or even on a cement walk if no mortar box is available. Building bicycle garages for people who do not have boys in the shop may be taken up as a class project and it makes the boys feel that they are doing something in the defense effort while the teacher is getting some valuable instruction across to them.

BILL OF MATERIAL

No. of pcs. required	*Material*	*Size*
4	No. 1 yellow pine S4S	1 in. x 3 in. x 8 ft.
10	No. 1 yellow pine S4S	1 in. x 2 in. x 6 ft.
11	No. 1 yellow pine S4S	1 in. x 2 in. x 8 ft.
2	No. 1 yellow pine S4S	1 in. x 2 in. x 10 ft.
1	¼-in. Plywood	25 in. x 7 ft.
1	½-in. Hardware cloth	24 in. x 24 ft.
1 lb.	Poultry netting staples	
1½ lb.	6-penny finishing nails	
1 lb.	4-penny finishing nails	



Framework of a bicycle garage

DRESSING THE SANDPAPER DISK

JOHN J. SCHMITT
Edison Technical and Industrial High School
Rochester, N. Y.

Of all the little odd jobs to be found in a pattern department probably the most irksome is cleaning the sanding disk or putting new sandpaper on it.

In a class of new students there are always a few who have not learned the proper sanding technique when using the sanding disk. These are the students who hold the piece of wood in one spot and exert too much pressure against the disk, with the result that a hard filler of wood accumulates between the gran-

Dressing the sandpaper disk

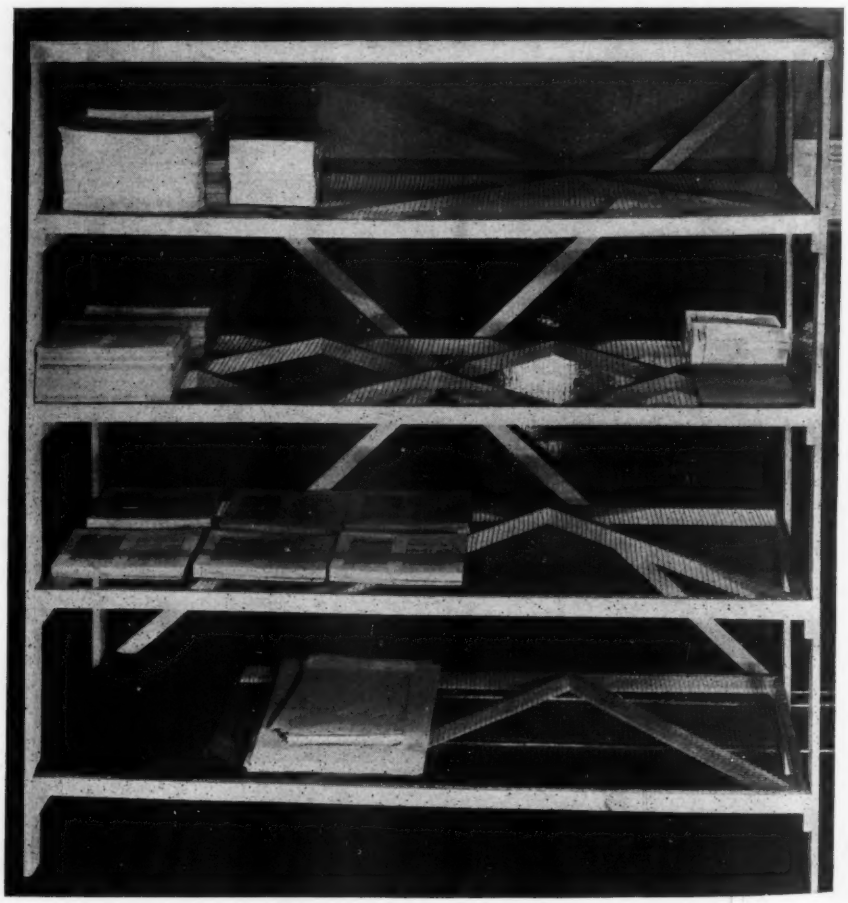
DRYING RACK FOR THE PRINT SHOP

STALEY BERRYMAN
Francis Joseph Reitz High School
Forest Hills
Evansville, Ind.

During the past five years we have used several makeshifts for drying purposes. The one described here has proved very satisfactory. It was constructed by four printing students at a cost of only $6.96. Due to modern trends in prices, the cost at the present time may be slightly higher. The four shelves afford 48 sq. ft. of shelf space which is quite adequate for our two job presses. The shelves are braced as shown.

The ½-in. wire cloth on the shelves has several advantages. It does not collect dirt; it is easy to see what is on the shelf above or below, and air circulates freely. To get the wire screen tight on the shelves the side rails were bowed in and each end of the screen nailed in place. When the side rails were released the screen stretched very tight. The braces were nailed in each shelf before the screen was nailed to the side rails.

A few dimensions and a bill of materials supplemented by the picture will enable anyone to construct this drying rack. Height over all, 78 in.; width, 25 in.; length, 74 in. The shelves are approximately 16 in. apart.



Drying rack for the print shop

ules of sand, thus ruining the sanding surface. After this happens a few times a day the job of changing the paper becomes monotonous.

The method described here obviates all of this trouble and extra work. Simply clean the disk in much the same manner as that used for cleaning a file. When the sanding disk becomes clogged, take the file card or brush, preferably a No. 10, and with a uniform motion and even pressure, draw it from the center to the outside of the disk as shown in the illustration. It must be remembered that the sanding disk must be standing still when this work is being done. The half tone illustrates how the operation is performed. The result is a surprisingly clean disk ready for more sanding use. Note how clean the disk is just beneath the brush.

A TIP FOR THE METALWORKER

VERNON D. STAPLEFORD
Morrill School of Mechanic Arts
Concord, N. H.

If you have been using a cloth to wipe off the soldering copper after it has been tinned, you may appreciate this suggestion. Secure a marine sponge, perferably a flat one, and construct a zinc box to keep it in. A tin box will serve as well if it is painted, otherwise it will rust and stain the sponge. Moisten the sponge and use it to wipe the coppers on.

This method avoids the danger of fire, and prevents burning one's hands. A sponge also does the job better than it would be done by the cloth. The sponge may be washed out if it becomes dirty from use.

Whittling-Jackknife Technique

W. BEN HUNT
Hales Corners, Wis.

(Continued from page 224 of the May, 1942, issue)

When first seen, the scarlet ibis shown in Figure 80, looks like a difficult job of whittling. Examination of Figures 81, 82, and 83 will show, however, that it will be no more troublesome than some of the other projects described in previous installments of this series. The one shown was cut out of 1¾-in. sugar pine. Trace the outline onto the wood and cut it out on a jig saw as shown in Figure 81. Then outline the shape with a pencil, after which rough out the ibis as shown in Figure 82. Be careful of the grain of the wood when whittling the bill and the legs. The actual whittling takes less time than it does to do the jig-saw work. Figure 83 shows the bird

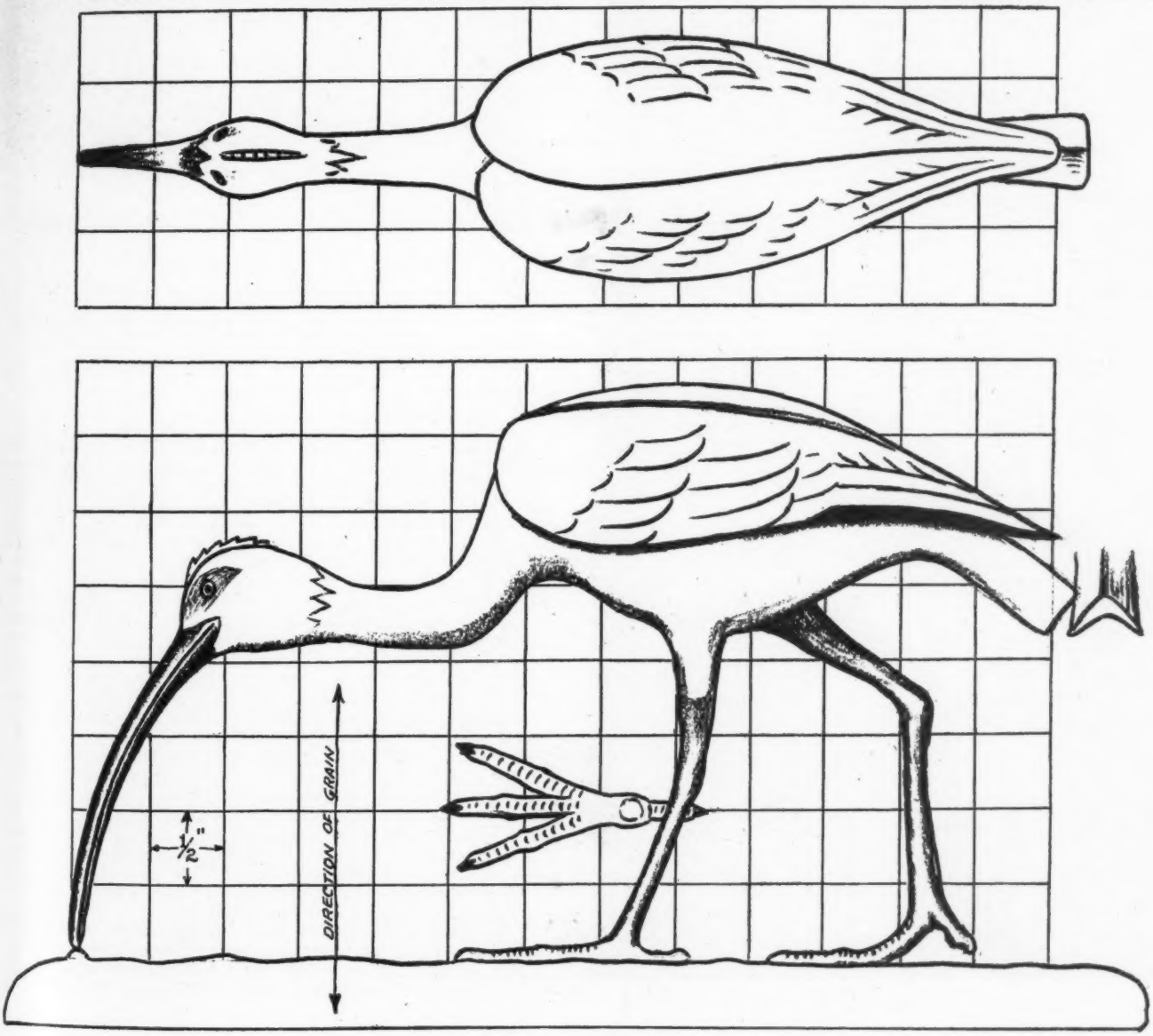


Fig. 80. Scarlet ibis

after sanding. As this is a scarlet ibis, it is not shown after painting, but only in the white. The author painted his bird a brilliant vermilion, with the feather outlines accentuated with brown; and the end wing feathers, eyes, and the bill, painted black. The legs are light brown and the base is moss green.

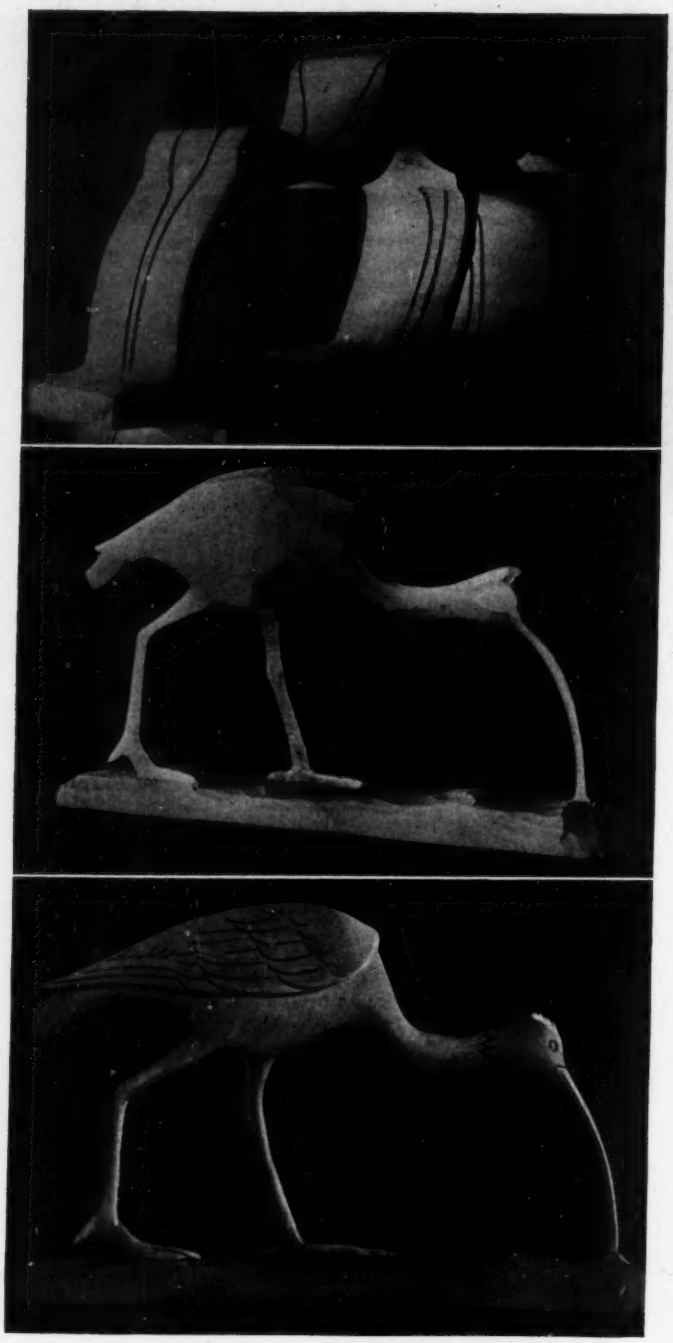
If objects of this kind are given three or four coats of white shellac, clear lacquer, or varnish, they will look like porcelain.

The pelican in Figure 84 shows another type of whittling. As shown, all the knife cuts were left. The whittling procedure, however, is identical with that used on the ibis, namely: jig sawing the silhouette, blocking out, and then finishing. This latter is carefully done, however, as each knife cut must tell a story. In finishing pieces left in the raw wood, it is well to give the object either a coat of white shellac, a coat of dull varnish, or several coats of liquid furniture or floor wax. Otherwise it will very quickly become soiled from handling, despite the fact that most of us think our hands are absolutely clean.

It is well to finish these whittled objects in various ways to take away the monotony that results in having all whittled articles look alike when finished. Some may even want to sand their pelicans. Several coats of eggshell ivory enamel may then be applied to make the finished object really appealing.

A very attractive table ornament may be made with the pelican used as a dish support as shown in Figure 86. The birds are whittled without the feet and are carefully sanded. The legs are then whittled of separate pieces and set into the body of the bird by drilling two holes. Holes are also drilled into the wooden circular base. The feet are then cut into the base as shown in Figure 86. The birds and base should be finished in ivory eggshell enamel. If the whittler is an all-round craftsman he may hammer a bowl of copper to fit the base, or a wooden bowl may be turned on a lathe and painted to match the base.

(See Figures 84 and 86 on next page)



Top, Fig. 81 — Center, Fig. 82 — Bottom, Fig. 83

Fig. 85. The pensive pelican

GRAPHIC ARTS PROGRESS

R. RANDOLPH KARCH

Principal, Printing High School
Cincinnati, Ohio

In a recent study by Deckinger, some startling facts were discovered about printed advertising. On the basis of dollar for dollar expenditures, it was found that half-page advertisements bring in 17 per cent more readers per dollar than full-page ads. Also, only one color, black, was 7 per cent more efficient than were two colors! Four colors were, of course, best of all, bringing in 17 per cent more than just one color.

Laboratory records show that the brightest of all papers scored 87 in the tests. This was an enameled sheet, often referred to as coated paper. Run-of-mine book paper scored about 75 in comparison, and bond 86 in the best grade. This is interesting to note because now readers will be able to detect a slight *tattle-tale gray* in their reading matter, caused by the requisitioning of chlorine (the bleaching agent) by the government for war materials. The new ceilings set up will limit the best rag writing paper to the score of 82, sulphite bond to 74, bristol and index to 74, and all grades of ground wood papers to 67.

One cannot simply select a color, and tell the printer to print it on any kind of paper. The paper itself is a factor, because light is refracted in different ways on various kinds of paper stocks. Absorption of certain color ingredients into the paper may change the color entirely. For example, if you try to print a light blue on a yellow stock, you might get a greenish result. The only way to lay ink or paint on paper to get the result you want, with any degree of accuracy, is to lay it on by silk-screen methods. This paint covers a paper in a thick film, and is unlike printing or lithography.

There seems to be room for great improvement in the training of estimators for printing plants, in view of the fact that as much as $10,000 difference in recent bids was noted in a government printing order. Low was $7,644, high $18,000. Unbelievable? Well, not if you buy much printing!

Newspapers are probably the worst offenders in typographical errors, and one proofreader-author notes that this is one sign that seems to indicate a lowering of standards. Newspaper manufacturing is not a criterion to follow, perhaps, but it is likewise true that publishers of books often print correction notices. The fault seems to lie in a general disregard for the training of correctors of the press. Just anybody with a higher education cannot make a good proofreader. This occupation must be learned like any other profession. The mechanical following of copy is not good proofreading.

The Department of Labor recently examined the newspapers, and found as many as 250 distinct occupations. The newspaper employers agreed to 176 jobs, and protested the balance. This study may well be regarded as significant by graphic arts teachers in laying out courses of study and curriculum content.

Many of the hues and crys about the paper shortages are considered by some to be fanciful dreams, and at least one investigator claims that the public is misled in this respect. But the authorities on paper do not agree on what is to come. Some say rationing of at least newsprint is inevitable, others say that only certain grades will be short. Still others claim that paper hoarders will be penalized by the government. The same is true concerning colored ink. Metallic ingredients will be short, if available at all. Research in new inks may help the situation.

The new *iron* electrotypes recently introduced to save copper are not, in reality, so much iron as a lamination of various metals. One solid layer of iron or copper or nickel is not as strong as a lamination of nickel, iron, nickel and finally copper. Anyway, an iron surface would rust under printing conditions. Because copper cannot be deposited well on iron in a copper electrolytic solution, the nickel film is introduced.

A gauge of the difficulties now being encountered by the graphic arts industries is seen in the report that thus far 7000 workers have left the newspapers to enter the armed forces. Fully 1875 of these were from the mechanical departments — printers and pressmen. In some cases, women are taking over duties which formerly occupied men. If this is true in commercial establishments, and it probably is, the graphic arts educator should investigate the training of women.

Although there is considerable transfer of training from letterpress work to offset-lithography presswork, the offset press worker is beset by three difficulties that the regular printer does not encounter. The action of the zinc plates (or even aluminum plates) on ink

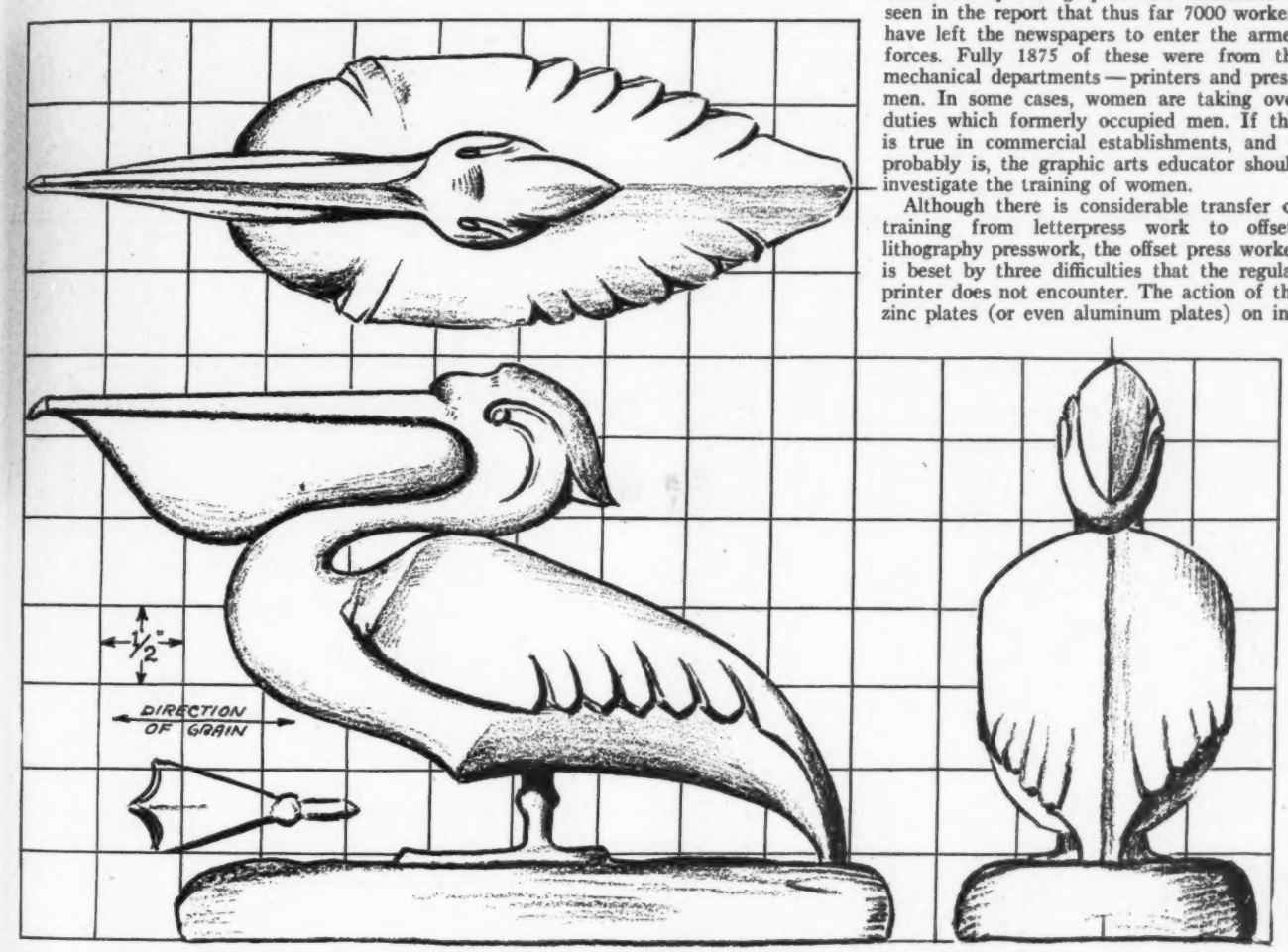


Fig. 84. Layout for the pelican

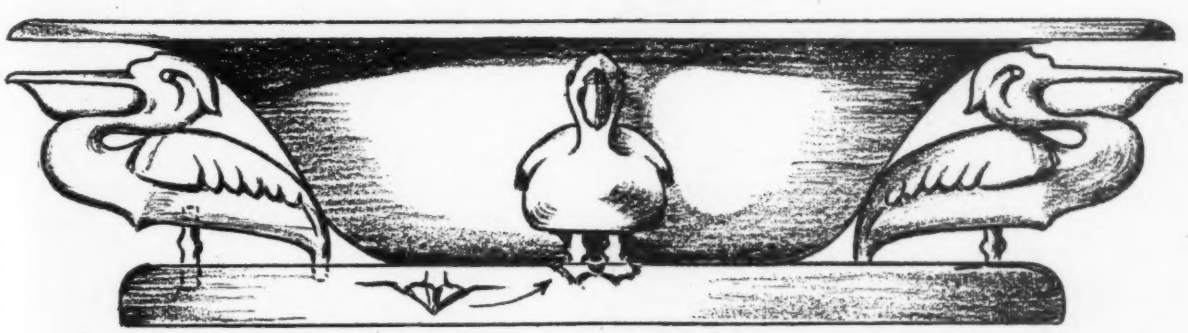


Fig. 86. Table ornament utilizing the pelican design

(For descriptive article accompanying Figures 84 and 85 see pages 265 and 266)

pigments and varnishes is one. Another is that the acids used are milled into the ink by the rollers used. A third is an emulsification of the ink by the wetting agents. If a letterpress man received a thorough training in the fundamentals of offset presswork, and has the necessary interest, he would probably make a good offset pressman. But to attempt to pick up the skills and knowledges as he would pick up golf or bridge would be unfortunate.

A trying time is expected by printers and lithographers due to changes to be made in both inks and rollers. Changes in ink ingredients will force the making of different types of rollers. Different types of rollers will undoubtedly come, because of government demands on glycerine, rubber, synthetic rubber and oils.

There is a slight trend toward larger type faces in text matter. Although seven-point type leaded two points seems to be more popular, a trend continues toward 7½, 8 and 9 point. In the 50 books of the year, Baskerville was most popular, with Caslon and Jansen second.

SPOT WELDED KITCHEN STOOL

OTTO A. STEINIKE

High School
Beaver Dam, Wis.

The kitchen stool illustrated herewith has been used as an eighth-grade project in our metal department. It was developed to give the students an opportunity to use all machines in the sheet-metal department, along with present-day fabrication methods. Since our shop is equipped with spot welder, spot welding is often resorted to, because it is safe, quick, practical, and abreast of the times. Since our students have an opportunity to select many of their projects, this stool has always been the most popular, and to date nearly 150 stools have been made.

The material used throughout is black iron sheet steel, and the operations listed give a clear picture of the procedure followed. These operation procedures might not always be in agreement with the best shop practices, but they work well in our department.

List of Operations

Legs — 4 required — 20 gauge

1. Cut stock 2 by 24 in.
2. Scribe fold lines, *K*, *N*, *M*, *T*, to dimensions

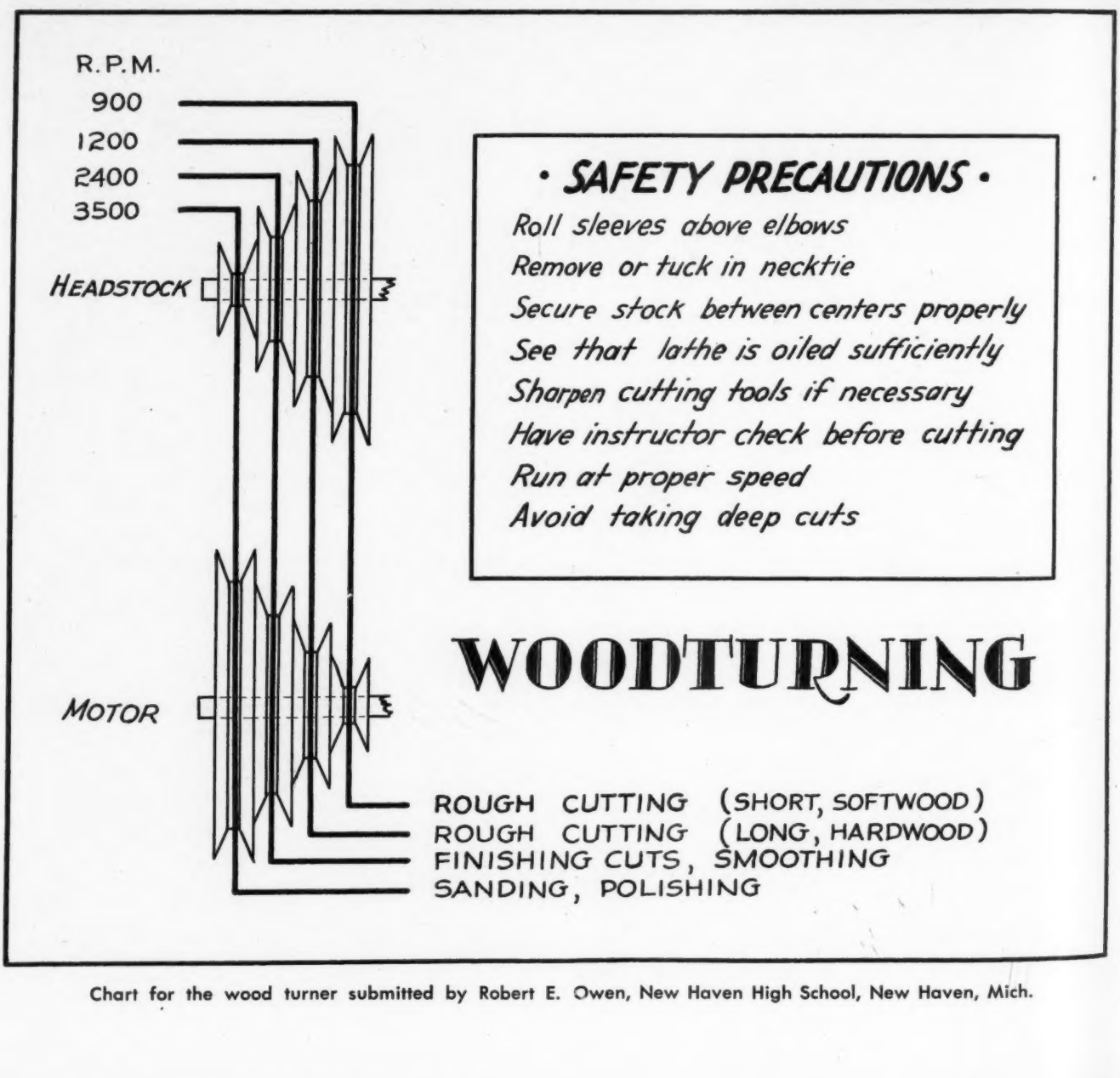
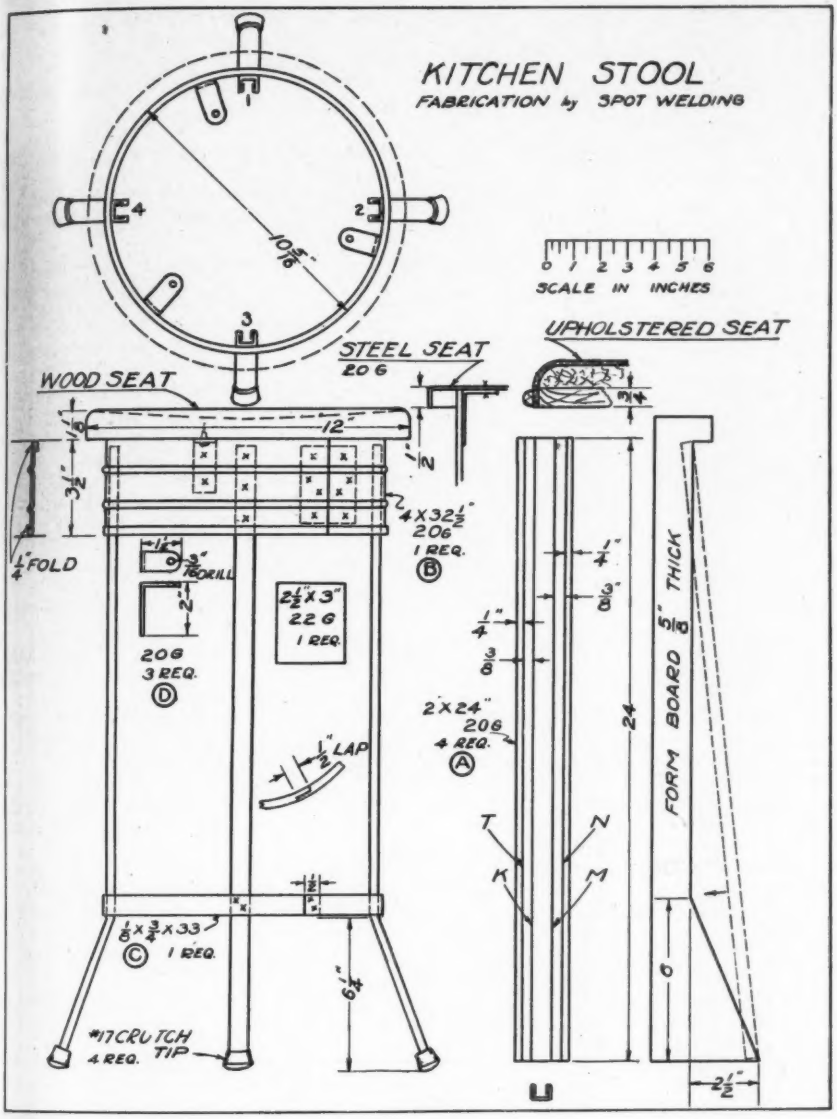


Chart for the wood turner submitted by Robert E. Owen, New Haven High School, New Haven, Mich.



Spot welded kitchen stool

3. Brake on lines *T* and *N*
4. Set down folds
5. Brake on lines *K* and *M* at 90 deg.
6. Form or shape legs on wood forms
7. Smooth all rough edges

Seat band — 1 required — 22 gauge

1. Cut stock 4 by 32½ in.
2. Scribe fold lines
3. Brake top and bottom folds
4. Set down folds
5. Run through forming rolls
6. Run through Beader (forming machine)
7. Cut joint piece, 22 gauge by 2½ by 3 in. Form slightly in forming rolls
8. Spot joint piece to one end of band, 4 spots
9. Join other end carefully and spot weld

Foot ring — 1 required — ⅛ by ¾ in. band iron

1. Cut stock 33 in. long
2. File lap recesses
3. Put through forming rolls
4. Spot lap joint
5. File and finish joint

Seat clips — 3 required — scrap 20 gauge

1. Cut to size ¾ by 3½ in.
2. Drill screw hole 3/16 diameter
3. Form 90 deg.
4. Spot to seat ring, 2 spots, 120 deg. apart

Subassembly

1. Center punch points on legs to make better contacts to foot ring
2. Divide seat band and foot ring in 4 equal parts — mark with center punch
3. Remove rust, oil, and dirt from areas to be spotted

Assembly — spotter should have helper

1. Locate points and spot foot ring to leg 1
2. Locate points and spot seat ring to leg 1, square on surface plate
3. Locate opposite point and spot foot ring and seat ring to leg 3
4. Attach legs 2 and 4
5. File and finish weld spots
6. If steel seat is used, spot seat to clips
7. Paint
8. Attach No. 17 crutch tips
9. Make wood seat and attach

Simple holding jigs are sometimes used to clamp the legs and seat ring together while welding, but this is not necessary if care is taken to locate points for assembling.

The legs are formed on the wood form shown, by putting form in vise and placing channel of leg on form edge, and using a mallet to drive leg down until it fits.

The wood seats are made in the woodshop from 5/4 stock; some are made of 4/4 stock and upholstered with hair and covered with red or green artificial leather.

We are not equipped to form or flange a 20-gauge seat disk as the drawing shows, so they are purchased from a local shop. The type of seat is left to the student. While the steel seat increases the cost of the stool 25 cents, nevertheless, it is the one usually selected.

The stools are painted and enameled 2 colors, after which the No. 17 crutch tips are attached. Sometimes the leg ends must be slightly formed to get the tips fitted.

The machines used to produce the stool are: forming rolls, beader, box and pan brake, spot welder, drill press, grinder and sheet-metal tools. A bar folder might be substituted for the brake if it is capable of handling 20-gauge steel.

Riveting may be substituted for spot welding, but then the stool will not be as rigid as a welded assembly.

HOW TO READ A RULE

CHARLES H. SECHREST

Dearborn, Mich.

A method of teaching pupils to read a rule, a testing device, and a test are included in this article.

Draw a large rectangle on the blackboard with white chalk to represent the outline of the rule. Divide the whole length into inches. Beginning with the second inch, divide the remaining inches into half-inches with a colored chalk. See the testing device, Figure 1. Starting with the third inch, divide the remaining inches into quarters with still another colored chalk. The fourth inch and the remaining inches may be divided into eighths with still another color. If the pupils are to be taught to read a rule that is divided into sixteenths of an inch, the fifth inch may be divided into sixteenths with still another color.

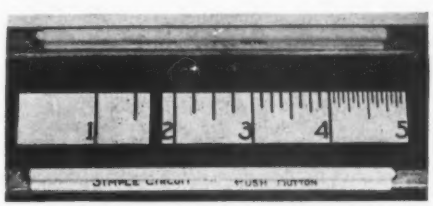


Fig. 1. Demonstration rule

After the lesson has thus been presented, the testing device, Figure 1, can be used for review. The black bar shown on the rule in Figure 1, is made to slide from one end of the rule to the other end to set it for various readings. The rule is made of 7/16-in. basswood, 6 in. wide and 40 in. long. Eight inches represents 1 in. The divisions and the figures on the rule are made with India ink and a speed-ball pen, No. 2. After the ink has dried a coat of shellac should be applied. Do not brush back and forth over the India ink for it may streak. Lay the first coat on as when

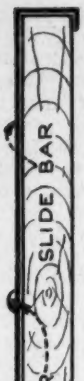


FIG. 2

Fig. 2. Section through demonstration rule.

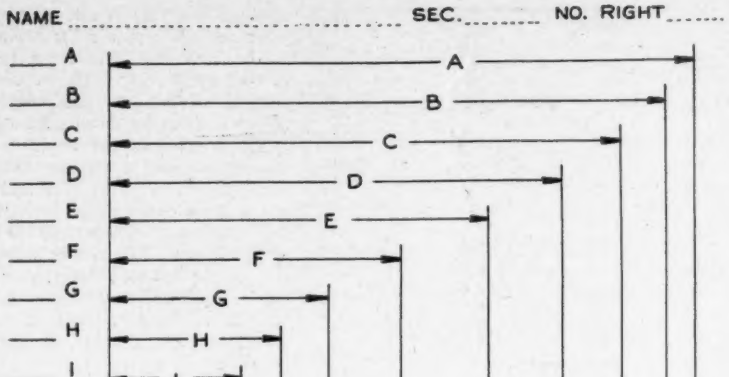


FIG. 3

Fig. 3. Test on how to read a rule

applying varnish. Additional coats of shellac or varnish may then be applied. The slide bar may be made of some suitable sheet metal. It is 1 in. wide and is made to slide on the rule as shown in the end view in Figure 2.

To measure how successfully the lesson has been taught, the test in Figure 3 may be given to the pupils. Two copies of a test this size may be made on one stencil.

TYPICAL AERO BENCH-METAL INSTRUCTION SHEET FOR NATIONAL DEFENSE

EARL L. BEDELL
Director of Vocational Education
ROLAND FRASER and CHARLES ADAMS
Detroit, Mich.

Spar Hinge Fitting (Project)

Reason for the Job: To learn the recommended procedures to be followed when making an airplane fitting and to gain an appreciation of the craftsmanship required to make a satisfactory fitting.

Safety: Never carry tools, especially pointed or sharp ones, in the pockets of your clothes; a collision or fall may cause an injury. Wear goggles when necessary.

Materials: One piece of cold rolled steel ⅛ by 3⅛ by 7½ in.; 1 piece of 2 by 2-in. emery cloth; 1 bottle of methyl violet; 1 bend block.

Tools: One combination square; 1 pair of dividers; 1 prick punch; 1 center punch; 1 hammer; 1 bench vise equipped with soft metal jaws; 1 10-in. mill file; 1 ¼-in. cold chisel; 1 drill press; 1 ⅜-in. drill; 1 ¼-in. drill; 1 3/16-in. drill; 1 ½-in. drill; 1 6-in. half round file; 1 hack saw.

Procedure:

1. Clean the fitting blank with the emery cloth.

2. Use a sharp pencil for making the layout lines. Do not use a scriber, as the surface scratches are not acceptable.

3. Prick punch all the centers for drilled holes and radii.

4. Lay out and prick punch a series of holes to form the slot that shapes the bent lug. Put the centers 13/64 in. apart.

5. Center punch all drill hole centers and radii centers.

6. Recheck the dimensions of the layout, especially the center distance, to eliminate any small errors that may have occurred while punching.

7. Mount the fitting in a drill press vise and check the alignment of the drill with the metal surface. Have a back-up block tight against the fitting.

8. Drill all the holes taking considerable precaution to obtain the true position. The drills used must be in perfect condition to obtain accurate work. The series of holes for shaping the bent lug should be drilled alternately, that is, every one. This allows the use of a smaller drill, if needed, and keeps the metal more rigid for drilling accurately.

9. Remove any drill burrs without rounding the edge of the holes.

10. Hack saw the excess metal from the fitting, keeping the cut 1/64 in. away from the layout lines.

11. Remove the excess metal in the slot with the small cold chisel and finish by filing with the 6-in. half-round file.

12. File the perimeter of the fitting to its true dimensions, taking care not to put file marks on the curved edges.

13. Place the fitting in the vise, using copper jaws, and align the bending block carefully with the lug to be bent.

14. Use a hammer and small block of wood to bend the lug 30 deg. The bending block corners, where the bending occurs, should be pounded with a radius of 3/16 in.

15. Clean the fitting with fine emery cloth.

16. Take the project to the instructor for a mark.

Reference: Metal Fitting — published by the Detroit Board of Education.

Questions:

1. Why is a sharp pencil preferred to a scriber for airplane fitting layout work?

2. May a jewelers' metal saw be used for cutting the slot used to shape the bent lug?

3. What might be the result if the lug is bent too close to the drilled hole in the lug?

4. What damage might result if the ¼-in. holes are drilled out of round?

5. Why must one keep the edges of the drilled holes sharp and round them?

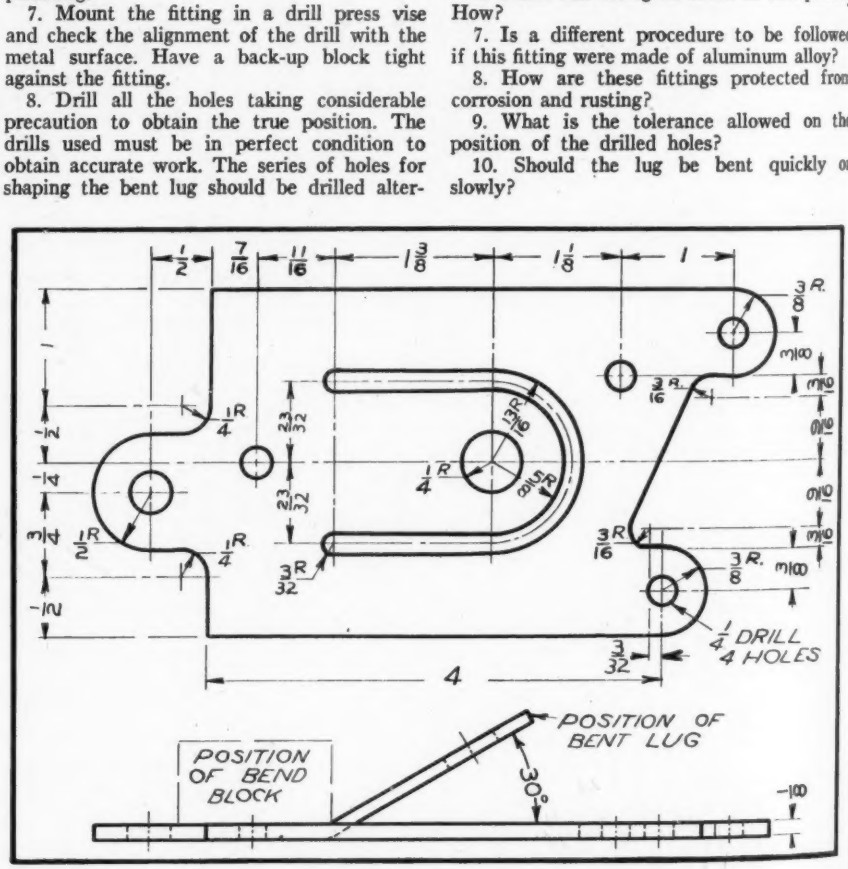
6. Could this fitting be made in two pieces? How?

7. Is a different procedure to be followed if this fitting were made of aluminum alloy?

8. How are these fittings protected from corrosion and rusting?

9. What is the tolerance allowed on the position of the drilled holes?

10. Should the lug be bent quickly or slowly?



Spar hinge fitting

(Continued from page 16A)

Dr. Edwin Moll, general secretary, Board of Foreign Missions, United Lutheran Churches of America, was the main speaker and his subject was "A Globe Trotter Sizes Things Up." His official duties as secretary of the Board of Foreign Missions of the United Lutheran Church of America made it necessary for him to visit Java, Borneo, Malaya, Sumatra, Bali, Singapore, India, Burma, and Australia. He returned recently from this trip, which occupied a year, and his viewpoints were based on observations made at firsthand.

Dr. John Donald Hicks, head of the history department, University of Wisconsin, spoke on "The United States as a World Power" at the general session Saturday morning.

At the business session the following were elected as officers for the coming year:

J. F. Jones, Madison, president; Clare D. Rejahl, Beloit, secretary-treasurer; Margaret Healy, Antigo, vice-president, representing commercial education; Frank B. Jewson, Superior, vice-president, in charge of co-ordination; and Mrs. Sarah Leslie, Stoughton, vice-president, representing homemaking.

♦ The printing teachers conference held in connection with the annual convention of the New Jersey Vocational and Arts Association at Convention Hall, Asbury Park, N. J., Saturday, March 21, was well attended by the New Jersey teachers and by the members of the New York Printing Teachers Guild, New York City.

The program was in charge of R. A. Loomis, printing teacher of the Dickinson High School, Jersey City, N. J. The main speaker was Eugene de Lopatecki, an instructor at Cooper Union, the New York Employing Printers Association School, and a member of the staff of the *Motor* magazine. He gave a most illuminating talk on design, showing step-by-step what constitutes a well-designed illustration. Hupp E. Otto, president of the National Graphic Arts Education Association, outlined the plans for the coming Pittsburgh Conference on Printing Education. Joseph M. Howlin, president of the New York Printing Teachers Guild, extended greetings and introduced some of the visitors who came from a distance including Mr. Otto of Wheeling, W. Va.; Allan Robinson of Baltimore; C. Harold Lauck, Lexington, Va.; J. Henry Holloway, New York City; and Fred J. Hartman, Washington, D. C. The IPI movie, "More than Meets the Eye," was shown.

Mr. Loomis showed some very interesting posters, the work of students of the Dickinson High School in the Flying Cadet poster contest held by the Jersey City Elks in cooperation with the U. S. Army Air Corps. One of the posters, that of Kenneth Sack, a printing student under Mr. Loomis, was selected by the military member of the committee of judges in the poster contest as the best design for the purpose of advertising for enlistments. It won the third prize for originality of design. He was also a prize winner in our recent essay contest.

Following the meeting, a fellowship luncheon was held at the famous Virginia Inn, in keeping with an annual custom. The arrangements were in charge of Vincent C. Coyne of the Middlesex County Vocational School, N. J., and treasurer of our Association, who did his usual good job.

♦ The sectional meeting at the Eastern States Association of Professional Schools for Teachers was held at New York City, March 28, 1942.

The industrial arts and vocational education sectional meeting was called to order at 10 a.m. by the chairman, Dr. Lawrence F. Ashley, chief, division of vocational education, board of education, Yonkers, N. Y.

Professor Raymond W. Phipps, director of the department of industrial arts and vocational education, Teachers College of Connecticut, New Britain, Conn., was next introduced. He explained the reorganization which had recently taken place in his program. New Britain now offers a combination teacher-training course for both industrial arts as well as vocational-education teachers. A new state supervisor of industrial arts is to be appointed who works with the Bureau of Youth Services. He said we should better train, in order to better sell, the product of our teacher-training courses. At the present time the state theme in Connecticut is "Learning to Make a Living." He went on to explain a new definition of industrial arts and the many changes which had been brought about with this program since the last war. There must be more clarification of our objectives in order to better sell our industrial-arts programs to the public. Does industry accept industrial arts? There never was a better time to sell it than right now. Credit should be offered to student apprentices for part-time work in industry. In answer to a question that was raised in regard to teachers who were better trained, Mr. Savage mentioned a personal letter and rating sheet which he had sent to all of his 130 industrial-arts teachers in Maine, as well as to every principal and superintendent of schools. In it he stressed the importance and probable chances of success for well-trained men in this field and encouraged all to recommend any outstanding student with necessary personality characteristics, mechanical ability, etc., to consider seriously the opportunities offered at Gorham.

Professor Richard M. Savage, director of the department of industrial arts, State Normal School, Gorham, Me., and state supervisor of industrial arts, was then introduced. He spoke on "Teacher Education — Needs and Plans." He began by telling the group what some of the recent changes were in the teacher-training facilities at the State Normal School, Gorham, Me., which is the only industrial-arts teacher-training institution of its kind in the state. The complete revision of the training program started two years ago and was modeled somewhat after the programs at Fitchburg in Massachusetts and Millersville in Pennsylvania. The three-year program was changed to one of four years, offering a B.S. degree in industrial-arts education.

(Continued on page 23A)

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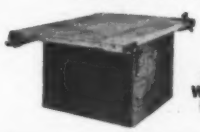
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Shop Equipment News

New Products — Publications

NEW 7-IN. METAL SHAPER

A new 7-in. metal shaper is being introduced by the Porter-Cable Machine Co., of Syracuse, N. Y. It is a self-contained motor-driven unit with motor and speed-change control mounted in the floor pedestal.

The length of ram travel is 7⅜ in., and it travels at any speed from 64 to 175 strokes per minute. A 4-in. diameter tool head swivels 360 deg. and travels 2⅜ in.

The ram is 16⅜ in. long by 5 in. wide. An 8 by 8 by 7½-in. table has a traverse of 10½ in., and vertical travel of 5½ in.

For smoother operation, this shaper is driven by a sprocket and chain drive. An extra heavy crankpin plate keeps chatter to a minimum. Six cross feeds are obtainable from .002 to .012. Tapered pins for quickly locating head and vise, and micro set ram for quick setup are other outstanding features on this shaper. It is equipped with standard ½ h.p. motor, and pedestal, the weight is approximately 485 lb., and it requires 14 by 19-in. floor space. The height is 51 in. over all.

MILLING SPEED CALCULATOR

The needs of today make it necessary to run production machines at their highest speeds consistent with the greatest number of pieces per sharpening of the cutters.

Men having little shop experience are inclined to run their machines either too slow or too fast. Both conditions can be a rather serious drag on production, especially where high-priced consumable cutters are employed, as on milling machines.

In order to make it possible for the operator of a Cincinnati Dial Type Milling Machine, manufactured by The Cincinnati Machine Co., Cincinnati, Ohio, to select the correct spindle r.p.m. for any combination of work and tool materials and cutter diameter, without guesswork or paperwork, the machines are now equipped with the built-in milling speed calculator shown in the illustration. It is, in effect, a circular slide rule, consisting of one stationary disk and two rotatable disks, with a semicircular cover plate in which are two windows.

Simple directions for operating are given directly on the calculator.

This firm also has a pocket size calculator for milling feeds and speeds for operators of milling machines that are not equipped with the calculator now built in on the Cincinnati Dial Type Milling Machine.

NEW DESIGN IMPROVEMENTS FEATURED IN LATEST VERNON NO. 0 MILL

New models of the Vernon No. 0 Horizontal Milling Machine, carrying advances in design, construction, and operation, have recently been announced by the Machinery Mfg. Co., Los Angeles, Calif.

The new improvements include labyrinth housings for the spindle bearings, and double rows of bearings on cross and longitudinal lead screws.

The power transmission also has been improved, with accurately balanced spindle-drive pulleys of increased size. Power-feed pulleys have been enlarged and belts are used from motor to vari-drive and from vari-drive to countershaft. The power-feed bracket is now equipped with two bronze bushings and is made more substantial throughout.

Other features of the latest Vernon models include: heavier knee, 2½-in. additional column height, lead screws increased to ¾-in. diameter and equipped with Zerk fittings on nuts. The overarm has been made 4 in. longer, and a new type pedestal, larger chip pan, and a motor platform with adjusting quadrant to accommodate 1 h.p. motor, have also been provided.

Complete information on the Vernon No. 0 Horizontal Mill may be obtained by writing direct to Machinery Mfg. Co.

PORTABLE WHEEL ALIGNING EQUIPMENT

This newly developed wheel aligning equipment offers a simplified method of checking front-wheel alignment which does not require permanent floor space or turntables. It accurately checks camber, caster, steering geometry, and toe-in, and it will work on any motor vehicle—cars, trucks, buses.

It consists of three units—a set of two camber-caster protractors—one for each front wheel; a toe-in trammel bar which has check marks which rest against the tire wall, a sliding gauge adapting the bar to different wheel-base widths; and a third unit which is an angle gauge to be used with the trammel bar for setting the wheels to correct angles for properly reading the steering-geometry degrees.

For further information write to the Snap-on Tools, Corp., Kenosha, Wis.

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To encourage tests by instructors, the Franklin Glue Co., Columbus, Ohio, will send a generous sample for this purpose to anyone making the request on an official school letterhead.

HYDRAULIC GRINDING MACHINES

The Cincinnati Milling Machine Co. and Cincinnati Grinders, Inc., Cincinnati, Ohio, have just issued two catalogs on Grinding Machines. The new 10-in. Plain Hydraulic Grinding Machine, a precision center type grinder is illustrated and complete specifications are given in catalog G-490. The 14 by 16-in. Plain Self-Controlled Hydraulic Grinding Machine is described and detailed specifications are given in catalog G-491.

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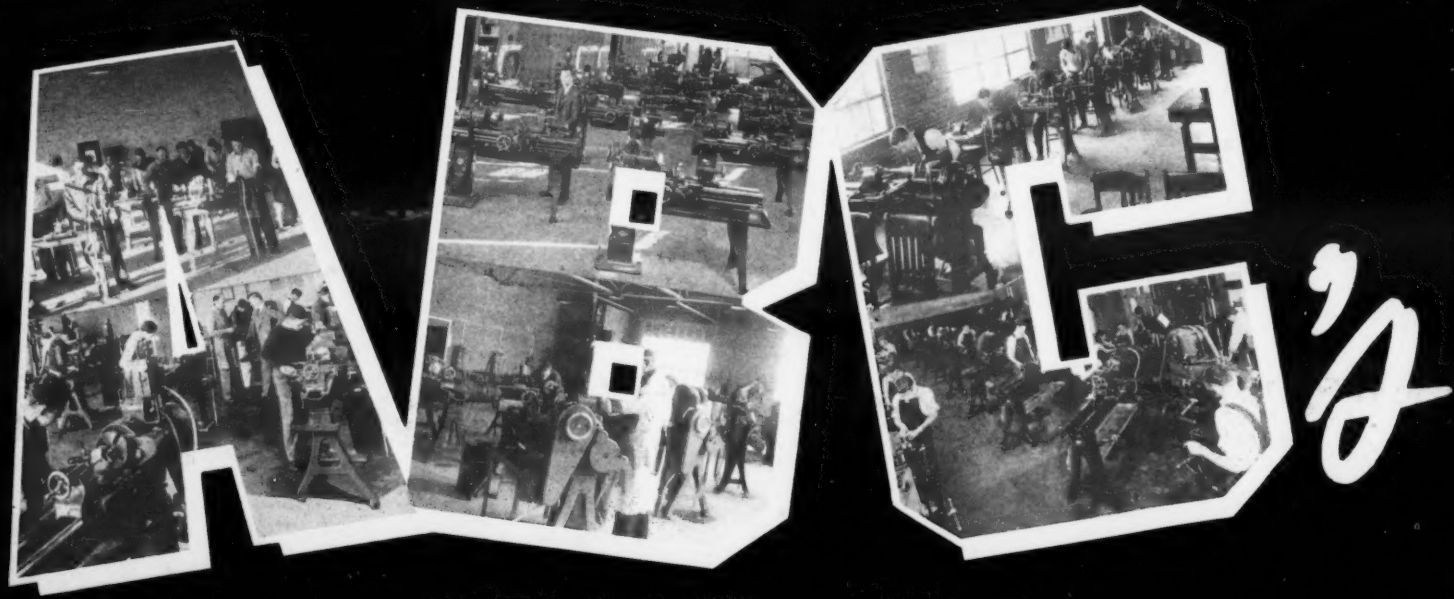

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